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OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

American Dyestuff Reporter was founded in 1917 and the Textile Colorist and Converter (formerly Textile Colorist) was incorporated with it in January, 1949. Published every other Monday by the HOWES PUBLISHING COMPANY, INC., 44 E. 23rd Street, New York 10, N. Y. C. R. Howes, President; Ernest J. Finan, Executive Vice-President; Norman A. Johnson, Vice-President & Treasurer; Myron D. Reeser, Vice-President; C. Essenbreis, Secretary.

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AMERICAN

DYESTUFF REPORTER

Devoted to Textile Chemistry
BLEACHING • DYEING • PRINTING • FINISHING

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AMERICAN
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VOLUME 43 JUNE 21, 1954 NUMBER 13

APPLICATION OF CHLORINE AND TREATMENT OF TEXTILE WASTES*

N S CHAMBERLIN

Wallace & Tiernan Inc, Belleville, N J

The author enumerates and discusses one by one the important mechanical and chemical tools employed in the chemical precipitation of textile wastes, and further suggests the chemical tools for the chemical precipitation of a possible combination of wastes.

INTRODUCTION

THE chemical treatment of textile wastes is certainly more complicated than many other waste problems. It has been stated, and is undoubtedly true, that the numerous textile wastes vary as widely in character as do the kinds and colors of the goods produced in the mills. This diversity is also reflected in the variation in chemicals, kind and amount, required for the treatment of each waste and in the degree of response of such chemical treatment. A more rational approach to the problem is desired than one based upon a "spelling-out" of the chemical treatment required for each of these numerous textile wastes.

A more simplified approach is available as a result of the excellent studies conducted under the auspices of the Textile Foundation. Through their work the chemical treatment of many of these wastes, individually and collectively, has become more clearly defined. In most of the prescribed chemical treatments only one basic chemical treatment is involved, namely chemical precipitation. Furthermore, in spite of the great number of wastes requiring treatment, the actual number of chemicals that *need be applied* are relatively few.

Thus, on the basis of the chemical process used, the subject of the chemical treatment of textile wastes becomes less complex and less confusing. Basically, the important aspects of a chemical precipitation plant are its mechanical features, the so-called mechanical tools, and the few chemicals that need be employed in the process, the so-called "chemical tools." It is the proper use of these tools, both mechanical and chemical, that makes the difference between the success or failure of the chemical treatment of these wastes.

DISCUSSION

In the field of industrial waste treatment, textile wastes are somewhat unique in that their chemical treatment at either the mill or the municipal sewage plant is well established practice. In some instances one or more of the raw textile wastes, depending upon stream conditions, receive chemical treatment prior to discharge of the waste to the stream or to the local municipal sewage plant. In other cases, the raw textile waste is delivered to the sewage plant where it receives chemical treatment either separately or in combination with the municipal sewage.

Chemical pretreatment of the waste at the mill or at the sewage plant materially reduces the load on the sewage plant and permits the textile waste to receive further purification in the biological units of the sewage plant. Chemical precipitation of the textile wastes at the sewage plant, either separately or in combination with the sewage, has the added and sometimes economical advantage of placing the treatment of both wastes under one management.

Textile wastes are treated with chemicals for the purpose of reducing certain constituents that are objectionable to the stream or to biological processes in a sewage treatment plant. Briefly, such treatment is used to reduce the odor, color, grease, suspended solids, BOD, acidity and alkalinity of the waste. The degree of such reduction is dependent in no small measure on how well the mechanical and chemical tools of chemical precipitation are used either at the mill or at the municipal sewage plant.

Textile wastes, like many others, may be treated in a "continuous flow" or "batch" type of treatment plant. Chemical treatment certainly conforms to continuous or intermittently continuous flow when the waste is treated along with the sewage at the municipal plant. This is generally also the case when the textile waste is pretreated separately at the sewage plant.

The "batch" type of treatment is practiced in one form or another at the mill. In normal fill and draw operations each individual holding tank is used for the chemical precipitation process. In some instances batch treatment is accomplished by treating the waste as it is pumped from one holding tank to another. This modified batch treatment has some advantages over the standard fill and draw procedure in that 1) it permits greater ease, uniformity and consistency in the addition of the chemicals and 2) it allows for retreatment of the settled waste before discharge to the stream or sewer.

Batch as opposed to continuous flow type of plant usually produces better results because equalization of the waste constituents and temperature is more thorough, the addition of the chemicals is often more accurate, and the settling is near perfect. Nothing is better than settling in a quiescent state at a temperature level that is not disturbing to the function of settling. When the waste flows are large, batch treatment may be too expensive due to initial costs of the plant.

In a continuous flow plant much of the success of chemically treating textile wastes separately or with sewage in no small measure depends upon adequate equalization of the raw waste. There is no particular problem involved in the recommended procedure of pumping the waste from the equalization tank to either the separate waste treatment units or to the sewage flow.

* Presented before the Third Southern Municipal and Industrial Waste Conference, N C State College, Raleigh, N C, March 18-19, 1954.

Equalization of the raw wastes before they are pumped to the point of chemical treatment is more important perhaps in the textile industry than in many others due to the greater diversity of waste waters, the great variation in dye wastes and the wide fluctuations in their alkalinity and acidity. In fact, equalization is a prerequisite for chemically treating textile wastes. Generally speaking, the better the equalization, the better the results obtained.

The equalization desired is that in which the incoming waste is instantaneously mixed with the wastes already present in the equalizing tank. This being too theoretical to be practical, the next best equalization is one in which the rate of change in pH, color and other waste characteristics is only gradual, i e, a percent rate of change sufficiently gradual to allow time for the proper adjustment of the chemical feeds either manually or automatically. It is advisable to have, in the presence of good mixing, an equalized waste volume that is not less than ten times that of the incoming waste volume. It is inadvisable, however, to have the equalized waste volume so great that it cannot be quickly and thoroughly mixed. When this occurs, stratification may ensue. Normally this means that the equalizing volume has a retention which is not in excess of one to two hours.

If, in meeting these requirements, the tank is too large for adequate mixing or circulation of the waste, it is then advisable to place two or more smaller tanks in series having a total retention of not more than one to two hours. By the same token, if raw waste slugging cannot be eliminated it is not advisable to have the single or series of two or more equalizing tanks too small. The waste volume or changing waste characteristics may be so great in relation to the equalized waste volume and its characteristics as to completely upset the state of equalization. Equalization is one of the mechanical tools that cannot be studied too carefully to obtain the desired end results.

The chemical tools used for the chemical precipitation of textile wastes are lime, sulfuric acid, ferrous sulfate (copperas), chlorinated copperas, ferric sulfate, ferric chloride, ferric alum, aluminum sulfate and chlorine. The choice of chemicals, alone or in combination, and the facilities for exercising their choice from time to time to meet varying waste conditions is of the utmost importance.

Lime and sulfuric acid are seldom used alone for chemical precipitation except for a few dye wastes. Lime is used to precipitate aniline black and indigo dye wastes. Sulfuric acid is employed to precipitate naphthol dye wastes. The principal use of lime and sulfuric acid is in conjunction with the other coagulants to maintain the pH of the waste at the level best for coagulation.

Copperas alone is excellent for treating sulfur dye wastes but is more commonly used in conjunction with lime for the chemical precipitation of cotton finishing wastes and dye wastes from the cotton, nylon and rayon textile industries. This chemical combination is particularly effective in treating wastes containing developed dyes, direct dyes, indigo dyes and vat dyes.

Ferric chloride and lime, like copperas and lime, is widely employed for chemically precipitating textile wastes, specifically the difficult deterging wastes and many dye wastes of the wool and cotton finishing industries. Ferric sulfate is specially effective for wastes containing direct dyes. Ferric sulfate and alum along with lime are good for treating rayon wastes. The effectiveness of ferric iron salts for the chemical precipitation of deterging and dye wastes makes them a particularly good choice as the chemical coagulating tools for the combined wastes from the textile industry. The excellent coagulating properties of the ferric iron salts are partly responsible, without doubt, for their giving excellent results.

In spite of these facts, the ferric iron salts have not met with much favor in treating textile wastes due to their expense and corrosiveness. This may be overcome by using chlorinated copperas, a ferric chloride-ferric sulfate solution mixture, prepared on site as needed from a solution of copperas and chlorine water. Every grain per gallon (or 143 pounds per million gallons of waste) of the relatively cheap copperas applied to the waste requires only one-eighth as much (or 18 pounds per million gallons of waste) of the more expensive chlorine to form chlorinated copperas.

It is easily manufactured by allowing the copperas solution to mix with the chlorine water in a pipeline about 15 feet from the point of application. The distance affords sufficient mixing and time to completely convert all of the copperas into chlorinated copperas. All of the copperas is oxidized to ferric iron just so long as sufficient chlorine is applied. The presence of ferrous iron or an excess of chlorine in the chlorinated copperas solution is determined by simple tests. As the conduit used for their mixing is generally transite, corrosion is no problem. Thus, chlorinated copperas is a reasonably cheap source of ferric iron and is made easily and as required without the corrosion problem generally allied with the use of the other ferric salts.

Aluminum sulfate or filter alum is used in the chemical precipitation of kier liquor wastes, indigo dye wastes and, in combination with ferric sulfate as noted above, for treating rayon wastes. While alum is definitely a chemical tool and is often used, it has certain disadvantages when compared to the heavier ferric iron salts in that alum floc is lighter, settles less rapidly, forms a less dense sludge, and is more easily upset in its settling by temperature differences in the waste.

The role of chlorine in the chemical precipitation of textile wastes requires defining. Its place in making a useful chemical coagulant, chlorinated copperas, has been described above. Chlorine also oxidizes or bleaches many dyes, at least partially, primarily those containing certain sulfur or nitrogen derivatives. In some cases, such as for sulfur dyes, it has been used in place of chemical coagulation. In such instances, chlorine is effective in removing the major portion of the BOD, but with most textile wastes the BOD reduction with chlorine amounts to only 15-25%. Generally speaking, chemical precipitation must be relied upon to remove most of the BOD that can be removed chemically.

In textile waste treatment, it is generally more economical and effective to apply the chlorine along with the coagulating chemicals or to apply it as a so-called finishing or polishing process to the effluent of the chemical precipitation process. Sometimes application of chlorine at both points is advisable, as it often increases the effectiveness of the coagulating chemical and, by minor application to the plant effluent, removes much of the remaining color. Thus chlorine applied properly to a textile waste being chemically treated makes it an effective adjunct to such treatment.

When a single known textile waste is to be treated, only the one or two chemicals specific for the waste are involved. The same is somewhat true when only the deterging wastes, the finishing wastes or a certain combination of dye wastes are involved. However, when many such wastes are combined and different dye wastes predominate at times, as is often the case, the problem of chemical precipitation of the textile waste from a mill becomes more complex. Heavy reliance on a cheap source of ferric iron is a partial answer to the problem. The best answer to the problem is flexibility in the choices of chemicals, i e, having available facilities for feeding copperas, alum, lime, sulfuric acid and chlorine.

From the above combination copperas, ferric iron (via the production of chlorinated copperas), and alum are always available as coagulants. In some cases, the desired flexibility is still available by omitting the alum. While lime and sulfuric acid are used occasionally as coagulants, their primary use is for pH control in the coagulation process. By means of a two- or three-way split in the chlorine feed, chlorine is always available to make chlorinated copperas, to apply along with the coagulant, and to apply to the treated waste effluent. Thus by having available the four or five basic chemical tools, one may solve almost every problem in the chemical precipitation of textile wastes

regardless of the apparent complexity of the wastes.

In order to obtain consistently good results, it is advisable to have chemical feeding facilities that are designed for ruggedness, for ease in handling the chemicals, for readily getting the solids in solution prior to their application, and for allowing for a reasonable degree of reliability and accuracy in their chemical feed, whether such feed be manual or automatic.

Flexibility in the sequence of feeding the coagulating chemical and the pH controlling chemical is a convenient mechanical feature that may spell the difference between poor or good coagulation. If floc formation is slow it is often advantageous to apply the lime ahead of the iron or alum coagulating salt to speed it up. If BOD reduction and color removal are not as good as expected, their removal is often improved by the addition of the iron or alum salts ahead of the lime. The sequence of chemicals is best established first on a laboratory stirring device and then applied in the treatment plant on the same basis.

Obviously, good mixing is of the utmost importance in a chemical precipitation plant, and one of the most valuable mechanical tools in such treatment. A quick, rapid and sometimes almost violent, thorough mix of the chemicals with the waste for a short period followed by a slow mix for a much longer period is generally recognized as being essential to good coagulation. It is a fact that, in coagulation of certain dye wastes, floc formation and its growth is accomplished with apparent ease. However, in the chemical precipitation of most textile wastes (and this applies to deterging, finishing and many dye wastes) conventional mixing, as described above, is a most desirable mechanical feature in obtaining maximum reduction in BOD, color, turbidity and suspended solids. The value of good mixing can never be overestimated.

It is stated that coagulation is to be at the optimum coagulating pH of the particular coagulant. Considerable data is available indicating that the optimum pH for ferrous sulfate is about 8.0, and for ferric iron and alum, about 6.0. Such figures are given only as a guide since the optimum pH values vary somewhat with the type of textile waste being treated. Furthermore, in the chemical precipitation of such wastes the optimum pH for maximum BOD reduction may not be the same as for maximum color reduction or for maximum suspended solids and turbidity reduction. Therefore, the optimum pH for a given coagulating chemical is likely to vary from the theoretical not only with the type of waste being treated, but the purpose for which the waste is being treated.

When BOD reduction and color removal are the primary reasons for chemically precipitating the wastes and the best coagulating chemical has a different optimum pH for the maximum reduction of each, it does not necessarily mean that one purpose of chemical precipitation must be sacrificed for the other. The dilemma may be solved satisfactorily by chemically precipitating at the optimum pH for BOD reduction and applying chlorine along with the coagulant or to the treated effluent or both for color removal.

The optimum pH should be established in the laboratory along with the chemical dosage and sequence of chemicals as previously noted. Whatever the final decision in respect to optimum pH, it is the pH that is supposed to be maintained just so long as the same coagulant is being applied to the same type of waste. If the pH is controlled manually, such control is assured only through careful observance of a pH recorder. If control is automatic, then a pH recorder-controller is a must. Only when such instruments are mechanical features of the treatment plant, can chemical precipitation be expected to give continuously the good results expected of it. Like good mixing, the control of pH through such devices can never be overestimated.

As for good mixing, it is almost redundant to state that good settling is desirable. In most cases such facilities are adequate. The desired retention time depends upon many factors, such as the design of the tank, the weight of the floc, the temperature of the wastes and many other minor factors. As the ferric iron floc is heavy and settles rapidly, it is particularly advantageous, if otherwise acceptable, to use ferric iron salts as the coagulating chemical in those cases where the settling time is not all that it should be.

The chemical requirements for the chemical precipitations of wastes are greater than those used for the normal coagulation of water. Also, it is to be recognized that the quantitative reductions of both BOD and color are substantially greater in the chemical precipitation of textile waste than in the coagulation of water. Fifteen to forty GPG or two to five pounds per 1000 gallons of waste of both metallic coagulating chemical and the pH controlling chemical are normally required to obtain the proper reductions of said constituents in the waste. These quantities of precipitating chemicals are exceeded only in treating a few dye wastes, notably sulfur dyes. The chlorine requirements are normally 100 to 250 ppm or 0.8-2.0 pounds per 1000 gallons of waste when used along with the coagulating chemicals. When applied to the treated effluent for final color reduction the chlorine requirements are quite generally less than 100 ppm or 0.8 pounds per thousand gallons of waste.

By employing the chemical precipitation process for the treatment of textile wastes, one may expect a BOD reduction of 20-80%, suspended solids reduction of 30-95% and a color removal of about 90%. While the amount of such reductions is somewhat dependent upon the type of waste or combinations of wastes being treated, the maximum possible reduction for such wastes is possible only through the full and proper use of the chemical and mechanical tools described above.

SUMMARY

The important mechanical and chemical tools employed in the chemical precipitation of textile wastes are enumerated and discussed one by one. Among the mechanical tools are 1) good equalization of the raw wastes, 2) proper chemical feeding facilities, 3) flexibility in sequence of chemical additions, 4) good mixing, 5) proper pH indicating or controlling facilities and 6) good settling.

The chemical tools adequate for the chemical precipitation of a possible combination of wastes consists of 1) ferrous sulfate (copperas), 2) lime, 3) sulfuric acid, 4) chlorine, and possibly 5) alum. In this chemical set-up chlorine is available for application 1) to copperas to produce the ferric iron coagulant, 2) along with the coagulant to make coagulation more effective, and 3) to the treated effluent as a finishing operation in removing much of the final color.

THE Annual AATCC Convention issue of the American Dyestuff Reporter on August 30th will include a separately-bound supplement entitled, "A Survey of the South". Its message will be of interest to all in the textile wet-processing field. Watch for it.

THE DU PONT JACKSON LABORATORY PACKAGE DYER

R H BLAKER and T W STRICKLIN
Contribution No. 153 from Jackson Laboratory
E I du Pont de Nemours and Co, Inc, Wilmington, Delaware

INTRODUCTION

THE development of new dyeing procedures in the Jackson Laboratory has required that a great number of dyeings be made under carefully controlled conditions. In order to facilitate this work, a small laboratory dyeing machine has been designed to supplement the use of the conventional one-pound package machines, which are commercially available. A number of these new machines made of type 316 stainless steel have been in use during the past year and have proved to be very useful for the routine dyeing of small quantities of fiber.

This laboratory dyeing machine has a capacity of 50 to 100 grams of fiber, either rawstock or yarn, with a bath-to-fiber ratio of 10:1 to 20:1. The machine is designed primarily for dyeing under steam pressures up to 50 psi, but it can be operated equally well at atmospheric pressure. A number of the mechanical features of the design insure that the operation of the machine will be relatively trouble free.

DESCRIPTION OF MACHINE

A photograph of the laboratory dyeing machine is shown in Figure 1*. The machine consists of a compact circulating system enclosed in a pressure vessel. The pressure vessel (E) is mounted on a stand and is designed to be heated from below by a Bunsen burner or an electric hot plate. The motor, pressure gauge, thermometer, relief valve, and funnel to make additions are located on the lid (D) of the pressure vessel. Figure 2 shows the pressure vessel removed from the assembly of the dyeing machine. In operation the centrifugal pump (P) forces the dyebath through the kier (B), which is loaded with rawstock or yarn. A concentric valve arrangement consisting of (B) and (C) reverses the flow of the dyebath when the handle (H) is turned. For ease of loading, the fiber is packed in the holder (A) which fits in the kier. A yarn holder (G) has also been designed to dye 3-inch yarn packages wound on perforated tubes.

The machine is filled most conveniently by running tap water directly through the bottom valve (#1) and overflowing through the top valve (#2). About one-fourth of this volume is withdrawn to give a volume which in operation submerges the intake side of the pump. Colors and chemicals are introduced through the funnel at valve (#3).

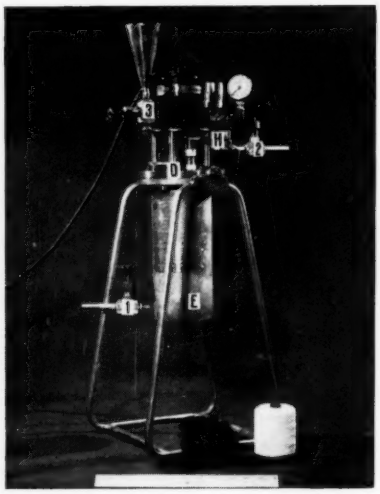

Figure 1

Figure 2

A schematic representation of the machine, shown in Figures 3A and 3B indicates the direction of flow of the dyebath. In Figure 3A the arrangement of the sleeve inside the kier is such that the bath is pumped down through the package. In Figure 3B the inner sleeve has been rotated to match another set of openings and the direction of flow is reversed. A similar arrangement for directing the flow of liquor from the inside to the outside of a yarn package and vice versa is shown in Figures 4A and 4B, respectively.

The pump is submerged in the dyebath to minimize vapor lock when the machine is being operated near the boiling point of the dyebath and to simplify the design

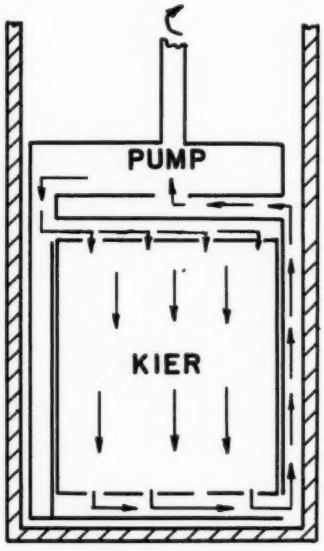

Figure 3A

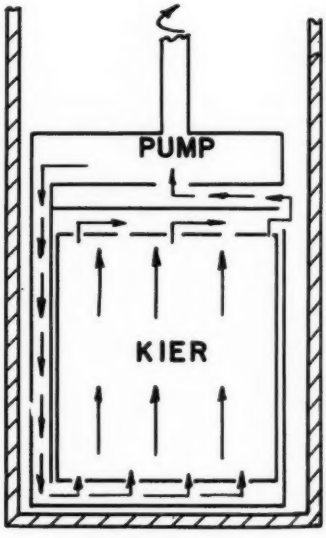

Figure 3B

* Sharpe and Flynn, Inc, Stokley above Roberts Avenue, Philadelphia 29, Pennsylvania, has fabricated a number of these machines for use in Du Pont laboratories.

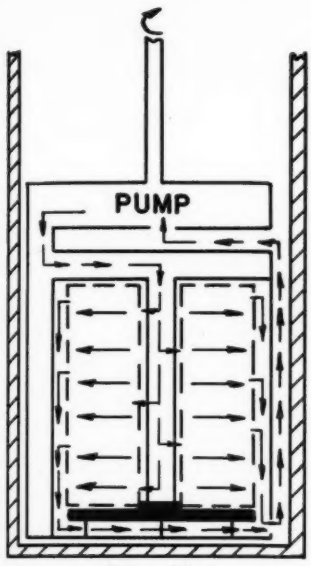

Figure 4A
Flow Inside → Outside

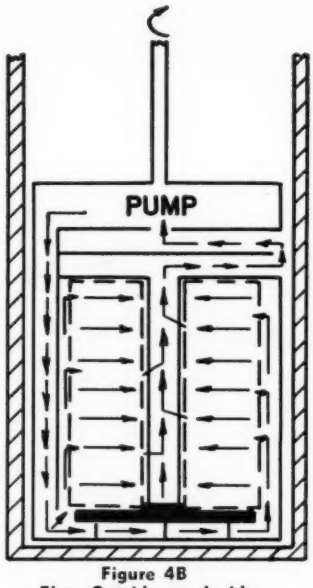

Figure 4B
Flow Outside → Inside

of the stuffing box on the shaft of the pump. This design limits the minimum bath-to-fiber ratio to about 10:1, but the maximum ratio is limited only by the depth of the pressure vessel.

DISCUSSION

The DuPont Jackson Laboratory Package Dyer has been used with practically all fibers and all classes of dyes. Most of the dyeings have been made at 250°F although the machine operates equally well at or below the boil. The results obtained agree quite well with those obtained in large-scale equipment.

These machines do not, and were not intended to, replace the one- and two-pound package machines in our laboratory. They are used to make dyeings intermediate in size between the dye pot and the one-pound machines, and for many purposes this is adequate. This machine should find considerable use in dyehouse laboratories for establishing formulas, working out process variables as well as developing new dyeing procedures. In operation, the machine requires a minimum of space and installation is simple. The cost of maintenance is very low.

Although the machine was designed for laboratory work, a number of the features might be useful in larger equipment. These include the submerged circulating pump, the method of reversal of flow and the method of loading the kier.

SUMMARY

The DuPont Jackson Laboratory Package Dyer is a laboratory dyeing machine designed to dye 50 to 100 grams of fiber at temperatures up to 300°F. The novel design permits dyeings to be made under a variety of conditions. The machine has been particularly useful in making routine dyeings during the development of dyeing procedures for the new synthetic fibers.

ACKNOWLEDGMENT

We wish to acknowledge helpful suggestions made by J F Laucius, T D Buck, W Monigle, H P Armstrong, L Maucher and particularly by R A Clarke.

ABSTRACTS

For the convenience of our readers, we list the addresses of the publications from which the following articles are abstracted:

Textile Research Journal, 10 E 40th St, New York, N Y
British Rayon & Silk Journal—St James House, 44 Brazennose St, Manchester 2, England
The Dyer—Drury House, Russel St, Drury Lane, London WC2, England
Canadian Textile Journal—223 Victoria Ave., Westmount, Montreal 6, Quebec
Zeitschrift fur Textile-Industrie—Lupertsender Strasse 161/163, M Gladbach, Germany
Melliand Textilberichte—Ebertplatz 3, Heidelberg, Germany

Prevention of Soil Redeposition in Textile Cleaning Operations by Proteins and Other Polymeric Materials

W Fong and H P Lundgren, *Textile Research J* 23, 769-75, November, 1953.

In any textile cleaning operation the ability of a detergent system to prevent soil from redepositing on the fabric after it has once been removed is of equal importance to its ability to remove soil initially. Investigators have referred to this phenomenon variously as "soil redeposition", "soil suspension", or "whiteness retention."

The importance of soil redeposition as a factor in detergent action was first stressed by Carter, who reported that the silicates and phosphates prevented redeposition much more effectively than sodium hydroxide or sodium carbonate when used as builders for soap.

In recent years the problem of preventing soil redeposition has assumed additional importance because of the relatively poor whiteness associated with the use of synthetic detergents in comparison with soap. A generally accepted postwar innovation for improving whiteness retention is the use of sodium carboxymethyl cellulose, a German World War II development, as a builder in detergent formulations.

The authors state in this report that certain proteins and other polymeric materials have been found highly effective in preventing the redeposition of carbon black, a test soil, on cotton fabric in aqueous cleaning systems containing an alkylarylsulfonate detergent and alkaline builders. The soil-redeposition-preventing properties of the various proteins tested were found to be correlated approximately with their proline content. The proline-rich proteins gave good to excellent whiteness retention. Of several synthetic polymer materials investigated, the uncharged types were more effective than the charged types. For the uncharged polymers, polyvinylpyrrolidone, polyvinyl alcohol, and polyethylene glycol, an optimum degree of polymerization was observed for maximum effectiveness.

Twelve references to the literature are cited.—WHC

Applications of Silicon Chemicals in Textile Processing

J Payne and E Smith, *British Rayon & Silk J* 30, 91-8, October, 1953.

There are three main fields of silicon chemistry in which important developments have taken place: silica sol, silicon esters, and silicones.

Silica sols, made from sodium silicate, have found a number of important applications in the finishing of fabrics. It is well known that slippage of yarns can be a serious problem in fabrics produced from certain types of continuous filament yarn, e g, nylon and rayon, or in fabrics of certain construction, e g, nets and nylon hose. Treatment of such fabrics with relatively small amounts of silica sols, however, produces a very marked anti-slip effect.

Silica sol also has a marked delustering effect and imparts a crisp hand to the fabric. It can be applied in conjunction with softening and stiffening agents where a special type of hand is required.

Silica aquasols can be stored almost indefinitely, do not yellow white fabrics, and are unaffected by light or micro-organisms. The finish is fast to drycleaning and withstands three to five mild soap washes.

Silica sols have found an important use in the treatment of glass fabrics to prevent yarn slippage and to ensure flat, unwrinkled fabrics for heat-setting processes. Such a treatment is used in the "Coronizing" process.

A recent method has been developed whereby silica sols can be exhausted onto a fabric. This process can be used in dyeing machines, such as the Smith-Drum.

Silica aquasol of 250A particle diameter gives improved strength and abrasion resistance to cotton and woolen fabrics, with excellent durability to drycleaning.

Silicon esters are usually prepared by the interaction of alcohols with silicon tetrachloride. It has been found that by application of ethyl silicate emulsions, excellent snag-resistant properties can be conferred on nylon hose. Certain silicon esters are also used to improve the abrasion resistance of textiles, particularly cotton goods. Treated fabrics are said to withstand more than 25 washing cycles.

Certain organic silicates have also been found to be effective anti-foaming agents and can be used for this purpose at very low concentrations.

The term "silicone" is used to describe a wide range of polysiloxanes, the precise physical properties of which are determined by their chemical constitution. The chemistry of the silicones is described in some detail by the authors.

One of the most outstanding characteristics of the silicones is their pronounced water-repellency, and this property is of great interest to the textile finisher. Broadly speaking, there are two methods by which silicones can be applied to textile fabrics for this purpose, which involve the use of monomeric silanes and prepolymerized siloxanes respectively. The second method is the more satisfactory to use, and has been employed on an appreciable scale for finishing purposes. This process, which is described, is said to produce a soft hand, and to give particularly satisfactory results with acetate rayon and polyamide and polyester fibers.

Wool is rendered nonfelting and shrink-resistant when treated with phenyl trichlorosilane. It appears that a film of polymer is built up on the surface of the fibers, masking the scales known to be responsible for shrinkage.

Fifteen references to the literature are cited.—WHC

Water-Resistant Wool

M Kolker, *Dyer* 109, 613-15, May 1, 1953.

The speaker expressed the view that the English people were "far behind" in their application of water-resistant finishes, and contended that all types of outerwear wool cloths should be proofed. He also pointed out the advantages of proofing wool undergarments as well.

Wool is, by nature, hydrophobic, but during processing to its final state it loses most of the property of holding off water. The object of proofing is to minimize the take-up of water, and at the same time to harm as little as possible the well-known properties of the wool. Shower-proofing should not entail lengthy processing and should not be costly. It does not affect the breathing of the textile, and prevents cockling, disfiguration due to uneven contracting, and expansion when wet — this is essential for unions.

The proofs have mostly been evolved from the use of aluminum salts of formic and acetic acids, though today there are proofs using zirconium and chromium in place of aluminum.

The first serious proof was obtained by prolonged hot application of aluminum acetate — the Mierzinski process. This proof was fairly good, but the process time of 24 hours was somewhat long. This was followed by the process using aluminum soaps this gave a poor handling cloth, tacky and harsh. Preparing the cloth in aluminum salts, followed by a passage through molten wax or wax in solvent, gave a better result, but the cloth became boardy and waxy. An improvement on the hand could be obtained by using a wax emulsion in place of the wax. These processes had the disadvantage that they required two baths.

A great step forward took place some sixteen years ago when a positively charged one-bath wax emulsion containing aluminum salts was brought out. Such products as Impregnol, Cerol, Migasol, Waxol, Ramasit, etc, came on the market; these emulsions were partially substantive to, or were absorbed by the fiber.

Some five years later the Mystolenes, of an aluminum-protein nature, were brought out, whereby a substantive proof was obtained without the waxy handle, though in some cases the cloth had a fuller feel.

Variations of the wax emulsions were to be found in the Persistols, using different types of wax in conjunction with zirconium with or without aluminum.

More recently Velan and the silicones have come on the market. Velan (octadecyloxymethyl pyridine hydrochloride), applied by padding and curing at 120-150° C, gives a very good proof with a soft handle, but is more expensive. A similar treatment is used in applying the silicones.

The speaker also discussed the theory of proofing and the different methods of procedure in applying the various processes. He concluded by enumerating the tests commonly used in evaluating water-resistance, suggesting that the Bundesmann testing method and variations on it gave the best test for shower-proofness of wool fabrics.—WHC

Some Causes of Damages to Wool Fibers

M Kehren, *Canadian Textile J* 70, #19, 61-4; #21, 81-3, September 11 and October 9, 1953.

A typical microscopic picture of the wool fiber shows the surface covered with scales similar to a slate roof. These scales consist of tyrosin-free Keratin A, and have more resistance to chemical attack than the core of the fiber, which can only be damaged if the surface is attacked. Under the epidermis is, first of all, the so-called subcutis, and under it a somewhat heavier layer of tyrosin, consisting of spindle-shaped cells glued together with an elastic substance. The inner core consists of tyrosin-containing Keratin C.

Wool being a protein, it must be expected to be sensitive to alkalis. Even weak alkaline solutions produce swelling of the fiber. Boiling caustic of 2 to 5 percent strength will dissolve wool completely. Soda ash or potash create damage to wool only in concentrated solutions at elevated temperature. Only a very strong alkaline attack will affect the protective scale-covered outer armor consisting of Keratin.

The wool protein is fairly stable in a pH range 4-7. Particularly at a pH of 4.9, the so-called isoelectric point, the swelling properties of wool are the lowest, and the structural strength is at its maximum.

Acids too cause swelling of the wool fiber, particularly at elevated temperatures, and primarily during the carbonizing operation. A high concentration of inorganic acids or too high temperature, as well as prolonged boiling with acids in dyeing, can create weakening of the wool fiber.

Concentrations of 1 to 6 percent of inorganic acid (based on weight of goods) can be used in the dyebath without weakening the wool fiber.

Wool is chlorinated to produce a high luster and destroy its felting properties. Chlorine reacts very quickly with wool, and to avoid damage to the fiber it is necessary to control carefully the pH of the bath, concentration of chlorine, time, etc.

Wool yarn was boiled for an hour in water containing various chemicals such as are used in dyeing. The author notes that water alone reduced the tensile strength nearly one-third; when anhydrous sodium sulfate and either acetic or sulfuric acid were added, the drop in strength was much less. After-chroming reduced the strength more than the metachrome process.

Suggestions are given for prevention of fiber damage during scouring, also in carbonizing and bleaching. The author recommends that "stripping and redyeing" should be avoided as much as possible, as the wool is exposed to a repeated damaging of the fibers. Particularly dangerous is an alkaline bleach followed by an acid chlorination, finished off with a hydrosulfite after-bleach.

The author also discusses several wool-protective products.

Metal Complex Compounds in Cotton Dyeing

Paltzer, Z *Textil-Industrie*, No. 13, 799-802 (1953).

Methods for using metal compounds in mordant dyeing have been known for a very long time, and it has been found that formation of these compounds follows exact stoichiometric proportions. Werner was the first to state that the aptitude of dyes to be fixed by mordants was correlated to their internal complex formation. The constitution of these dyes therefore depends on the presence of a salt-forming group capable of bringing about an inner complex with the metal atoms. It has been observed that preponderant formation of 5- or 6-membered rings occurs. Atom groups suitable for this reaction are characterized by adjacent hydroxy and carboxy or azo groups wherein Cu or Ni are complex bound with only one valence while the other is present as a monovalent ion.

The light fastness of Direct Blue RW (C I 512) and Direct Sky Blue (C I 520) is substantially improved by aftercoppering. However, the solid copper complexes of these dyes are sparingly soluble, and will decompose in hot alkaline treatment and thereby lose some copper. Direct dyes containing complex-bound copper have been synthesized as derivatives of o-aminophenol in which the Cu atom is bound to O with a salt linkage, and to N with a secondary valence, or (more firmly) to two hydroxy groups adjacent to N:N, as in the case of Chlorantine Fast Violet 2RLL.

After about 15 years of systematic work the Coprantine dyes were developed. When hydroxy groups are substituted for methoxy groups in the aforementioned blue dyestuffs, new 6-membered rings are formed. Here the copper-complex formation takes place in the exhausted dyebath, substantially changing the shade. Fastness to light and washing of the after-coppered Coprantines are said to be very good in contrast to noncoppered dyeings and quite generally better than those of the standard lightfast direct dyes, but the fastness to boiling or chlorine of vat dyeings is superior—In German.—PW

Surfactants in Textile Processing

Rordorf, Z *Textil-Industrie*, No. 14 (1953).

The primary objective of the first textile assistants was that of improving wetting properties; leveling (retarding), dispersing, stabilizing agents, etc, subsequently have been developed, and the term "surface-active agents" (or surfactants) as we know it today applies to various compounds having different effects.

After presenting a valuable survey of the constitution of standard wetting agents, the author discusses the principle differences in dyeing wool with acid and chrome-complex dyes.

In customary acid dyeing the mineral acid anions which form salt linkages with amino-N groups have to be replaced gradually by dyestuff anions. It is necessary to retard this reaction by intermediate combination with appropriate assistants when using difficult-to-level dyes of good fastness, such as the milling dyestuffs.

The chrome-complex process is characterized by salt formation, which results in the gradual formation of ammonium groups [cf Eloed, *Melliand Textilber*, p365 (1932); p67 (1936); p49 (1937)], and also in the formation of chrome linkages with nonionized amino groups. In this method hydrophilic, oxyethylated high-fatty alcohols, e g, of the Peregal type, have to be used.

The author also discusses the problem of converting precipitated naphthols into a finely dispersed state.

Many kinds of finishing processes requiring different types of assistants are discussed—In German.—PW

Sorbit as a Substitute for Glycerine in Vat Printing

Mueller, *Melliand Textilber*, 766-7 (Aug, 1953).

Various substitutes for glycerine, which is generally used as an additive in vat and discharge printing, have been advocated in the past. Less expensive compounds, such as glycols and derivatives thereof and urea, have been applied with some success but the paste proved to be unstable in storage.

Sorbit . . . $CH_2OH.(CHOH)_4CH_2OH$ . . ., marketed by Merck as a 70% water-miscible solution under the tradename Karion F Liquid, is claimed to solve this problem. It reportedly is less hygroscopic than glycerine, will not absorb excessive atmospheric moisture and consequently, serves to prevent premature decomposition of Rongalite in storage. Moreover, slight differences in moisture content of the steam do not cause such substantial differences in aging results as those observed in prints containing the more hygroscopic glycerine. Samples of comparative prints and formulas are presented—In German.—PW

The Influence of Ultrasonic Waves on Fibers

Rath and Merk, *Melliand Textilber*, 653-6 (July, 1953); 763-5 (Aug, 1953).

Alterations of fibrous materials under the influence of ultrasonic waves frequently have been investigated. In recent publications the authors enumerate many references, among others, Brit P 587,214 of Am Viscose Corp [cf *Am Dyestuff Reptr* 37, 104 (1948)] and U S Pat 2,470,453 (Wolsey Ltd—Alexander) [cf *Am Dyestuff Reptr* 38, 585 (1949)]. The purpose of the present work is to determine the destructive action brought about by ultrasonic influence.

The following factors must be taken into consideration: mechanical influences of the pressure of the waves; molecular frictions; formation of cavities, especially in liquids, by the impact of resonance of vibrating gas bubbles on a standing sound wave; dialytic phenomena occurring on cell membranes; thermic influences and physico-chemical reactions, such as depolymerization, or formation of ionized products, such as H, hydrogen-peroxide, ammonia or nitrous acid, in cavities.

Various fibers, such as natural and regenerated cellulose, protein fibers, Perlon and human hair, fixed in a frame were inserted in a tank filled with distilled water of 20-30° C and subjected to ultrasonic waves of increased intensities. Fiber damage was best observed at a definite frequency, where strong cavities formed in the liquid and coherent bubbles extending in vertical direction above the

vibrating parts were noted increasing with the height of the supernatant liquid. The maximum reaction was observed at this point. Single fibers were strongly changed up to complete destruction, while woven fabrics remained virtually unaltered. The experiments, illustrated with many comparative photomicrographs, proved that fiber damage can be expected only when a material is introduced into spaces where ultrasonic waves are apt to produce strong internal cavities. Gas bubbles vibrating in the ultrasonic fields are capable of increasing substantially hydrostatic pressure and of destroying completely cellulosic fiber structures, although wool and Perlon are not damaged at all. On the other hand complete destruction of human hair becomes evident in ultrasonic treatments—In German.—PW

Determination of Amino Groups in Polyamides

Zahn and Rathgeber, *Melliand Textilber*, 749-52 (Aug, 1953).

Every molecule of the linear polyamides of the nylon or Perlon type contains one terminal carboxy group and one amino group. Affinity of the acid dyes depends on the number of these groups. Since this number is far smaller than that present in wool (the authors calculate 0.80 milliequivalents pro g cationic groups for wool in contrast to 0.05 g pro g of nylon), the maximum adsorption of acid dyes would be of the ratio of 30% for wool to 2% for polyamides. Thus evidently the number of free amino groups is essential for the acid dyeing process. Several scientists have determined the maximum of absorption at pH 2-2.5. A simple method devised by Eloed and Froelich comprises immersing the material at pH 2.5 in n/200 acid solution and measuring thereafter the increase of pH, i e, the decrease of acidity.

The authors have developed a new colorimetric method based on material published by Sanger in *Biochem J* 39, 507 (1945); m-dinitrofluoro benzene links to free amino groups (of proteins) forming yellow substances. This method proved to be very sensitive. The authors isolated and studied the dinitrophenyl-substituted degradation products of the protein amino acids and subsequently those of linear polyamides. The "DNP" polyamide was prepared by immersing the polyamide specimen in alcoholic bicarbonate solution of dinitro fluorobenzene and disolving the purified product in propargyl alcohol.

The figures obtained by observing the point of extinction in a photocolorimeter were correlated with those plotted on a standard curve; the values corresponded well with figures resulting from the above mentioned acid-binding method—In German.—PW

Reactions of Different Aminoplast Resins Used as Finishes

Eloed and Joerder, *Melliand Textilber*, 860-3 (Sept, 1953).

Aminoplasts for use in creaseproofing, shrinkproofing, etc are tested primarily by qualitative methods. Fabrics containing them are immersed in boiling 2% sulfuric acid in order to establish the presence of formaldehyde and, in NaOH, to develop ammonia from the nitrogenous base. But the latter reaction does not disclose whether the N-component is urea, melamine, dicyanodiamide or another N-containing base.

Ernst and Sorkin list in *Textil Rundschau*, 237 (1949) a series of individual and mixed dyes giving specific reactions with different commercial resin finishes. However, most of the samples to be investigated are colored; moreover, the shade obtained depends on the (unknown) concentration of the resin applied.

An improved method which can be used for colored as well as uncolored samples is described in the current article. The resin is stripped from the fabric with 0.1 n hydrochloric acid, and a drop of this solution put on a strip of filter paper is transformed into the resin again by heating, thus forming a colorless spot. Details of this procedure are disclosed. Comparative tests are made by dropping different resin solutions onto the filter paper and dyeing in selected dyestuff solutions. The reactions of these dyes with resins of the urea type (Kaurit), of melamine resins (Cassurit or Lyofix), and of dicyanodiamide- and thiourea-resins are reported and illustrated by a colored photograph. The amount required for the test is negligible; the test takes about 30 minutes for a soluble precondensate and 60 minutes for a cured resin. Two tables refer to reactions with hydrolyzed and hardened products or with hydrophilic precondensate solutions respectively—In German.—PW

Washing Fastness of Wool Dyeings Improved by Modifying Wool

Alexander, *Melliand Textilber*, 656 (Aug, 1953); 855-7 (Sept., 1953).

The author discusses in a very comprehensive way the physico-chemical mechanism of wool dyeing as investigated by Meyer, Eloed, Speakman, Harris and coworkers. When wool is dyed in acid, e g, hydrochloric acid solutions, the chloride ions first linked to the wool molecule are exchanged by dyestuff anions somewhat in an analogous way to the dehardening process of water by anion exchanging products, such as Zeolite. The dyestuff affinity for wool depends on the presence of secondary valences and it is increased with increasing molecular weight of the dyestuff ions, which are superior in this respect to the ions Cl^- or SO_4^- that have practically no affinity. In contradistinction to the acid dyeing methods, dyeing from neutral solutions proceeds merely on the basis of absorption of dyes of high affinity by means of secondary valences, i e, the dye is no longer linked to the fiber by electrostatic forces. Thus a typical acid dye will lose its affinity to the fiber when brought into a neutral condition. In this event the carboxy groups will saturate internally the positive charge of the amino groups and the dye anion can no longer be bound by the electrostatic forces. Wool adjusted to alkaline state will produce a negative charge and repel the dye anion. Consequently the dyeing properties of wool can be fundamentally changed by blocking (fixing) the carboxy groups in such a way that the wool molecule can no longer acquire an electric charge in acid or neutral solutions, becoming practically electroneutral. Under these conditions wool would accept the aforementioned "simple dyes" from acid or neutral solutions by way of an ion-exchange process, giving the same good fastness effects as neutral-dyeing dyes on wool that is not pretreated.

Blocking by esterifying the carboxy groups was first described by Schlack (cf U S Patents 2,202,169 and 2,131,146, etc). For this purpose he tried a number of known alkylating agents and established the probable equations for this reaction. Practically, a treatment with epoxides, and particularly with epichlorohydrin, seemed to give the most promising results.

The author claims to have found a simpler way———esterifying the wool carboxy groups by refluxing the material in the presence of water-free alcohols (methanol, propanol, butanol containing 0.1 n HCl). The washfastness of the dyeings, however, is not as high as might be expected because the formed esters decompose rather easily. The process seems to be useful for special effects and for contrast dyeings of mixed treated and untreated material. A suggested manner for improving these results calls for enzymatically eliminating the carboxy groups or by a specific reduction method. Any method capable of durably blocking the carboxy groups would result in uniform and washfast dyeings with a "simple" leveling dye because the dye molecule would firmly adhere to the fibers, similar to the neutral dyeing compounds. In addition, the leveling properties in acid dyebaths would persist at the same time.

Great improvements in dyeing chlorinated wool may be expected provided the stability of the ester-type compounds produced in this process can be increased.

Apparently the author's Brit P 692,924 (assigned to Wolsey Ltd) [cf *Am Dyestuff Reptr* 43, 163 (1954)] covers the practical application of these findings—In German. —PW

Proceedings of the
American Association of Textile Chemists and Colorists

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Editor of Proceedings: Carl Z Draves, 30 Lahey St, New Hyde Park, N Y

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Arsene J Berube
James Cosgrove

EMPLOYMENT REGISTER

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54-10

Education: College degree, textile chemistry & dyeing.
Experience: Chemist, dyer, finisher, superintendent.
Age: 33; married; references; northeastern U S preferred but not essential.

6-7, 6-21

54-11

Education: High School, England
Experience: Supt of finishing, synthetics; plant manager; Canada and U S
Age: 47; married; references; New England preferred but not essential.

6-7, 6-21

54-13

Education: high school and correspondence schools.
Experience: foreman and superintendent of finishing.
Age: 49; married; references; northeastern U S preferred.

6-21, 7-5

54-12

Education: chemistry & dyeing, college evening course.
Experience: laboratory and dyehouse management, development of dyeing processes.
Age: 55; married; references; now operating own laboratory, but desire position in dyestuff application, research or process development, location immaterial.

6-21, 7-5

AATCC CALENDAR

COUNCIL

1954—Sept 15, Nov 19.
1955—Jan 21, Apr 15, June 17

NATIONAL CONVENTIONS

Sept 15-18, 1954 (Atlanta Biltmore, Atlanta, Ga); Sept 21-23, 1955 (Chalfonte-Haddon Hall, Atlantic City, N J; 1956 (New York); 1957 (Boston).

NORTHERN NEW ENGLAND SECTION

Oct 8 (Colonial C C, Lynnfield, Mass); Dec 10 (Woodland Golf Club, Auburndale, Mass).

PACIFIC NORTHWEST SECTION

July 24 (Outing, Mt Hood Golf Club).

PIEDMONT SECTION

Oct 16 (Hotel Barringer, Charlotte, N C).

PHILADELPHIA SECTION

Sept 24, Oct 29 (Penn-Sherwood Hotel, Philadelphia, Pa); Dec 3 (Kugler's Restaurant, Philadelphia).

RHODE ISLAND SECTION

Oct 14 (Johnson's); Dec 2 (Annual Meeting—Sheraton Biltmore, Providence, R I).

SOUTH CENTRAL SECTION

Dec 4 (Hotel Patten, Chattanooga).

SOUTHEASTERN SECTION

Dec 11 (Atlanta-Biltmore, Atlanta, Ga).

WESTERN NEW ENGLAND SECTION

Oct 1, Nov 12, Dec 10 (Rapp's).

(A general calendar of events may be found on page 417)

Western New York Section Organized

A DINNER inaugurating the Western New York Section held June 4, 1954, at the Westbrook Hotel, Buffalo, New York, was attended by twenty-four members, including seven from Canada. Many others were interested in attending but previous engagements prevented.

A brief resumé of the purposes and outstanding accomplishments of AATCC was followed by a lively discussion of plans for section activities. Many interesting suggestions were made for the guidance of the section officers.

The election of officers resulted in the following choices:

Chairman: Jean G Kern, *National Aniline*

Vice Chairman: John Wallace, *Supersilk Hosiery, London, Ont.*

Treasurer: Anton M Viditz-Ward, *Van Raalte Company*

Secretary: Margaret R Hallinan, *National Aniline*

Councilor: J Edward Lynn, *National Gypsum*

The election of sectional committee members was postponed until the Fall.

There was much interest in holding joining meetings, both in Canada and the United States with the Ontario Section, whose current president is J Wallace, of the CATCC.

The enthusiastic atmosphere prevailing in this inaugural meeting of the first International Section of the AATCC anticipates steady growth into a vital, strong section.

Respectfully submitted,
J. EDWARD LYNN
Secretary, pro tem

1954 National Convention and "The South's First Textile Wet Processing Exhibit"——

SPONSORED BY THE SOUTHERN REGION ★ THE ATLANTA BILTMORE ★ ATLANTA, GEORGIA ★ SEPTEMBER 15, 16, 17, 18

ATLANTA CONVENTION TO FEATURE CORPORATE MEMBERS DAY

Dining Committee Announces Plans

C Norris Rabold

C NORRIS RABOLD, chairman of the Corporate Membership Committee for the 1954 National Convention, announces that special invitations to each Corporate Member in the Southern Region will be issued urging their attendance. Thursday, September 16, will be set aside as CORPORATE MEMBERS DAY, and, following a reception for the honored guests at 10:30 AM, the group will be conducted on a special tour through the Exhibition Hall. The top level executives of the Corporate Member companies will be honored guests at the Olney Award Luncheon at 12 noon.

AATCC Corporate Members perform a very valuable function in the promotion of research, and it is hoped that many of them will avail themselves of the opportunities of seeing the Association's research committees at work, attending the technical sessions, and enjoying the sociability of the Annual Meeting. Individual invitations to Corporate Members will be mailed in due time to allow them to make the necessary plans to attend.

* * *

JOE T BOHANNON, chairman of the Dining Committee, reports that plans are well underway for the Olney Award Luncheon on Thursday, September 16th; the Alumni Luncheon on Friday, September 17th; a Football Buffet Luncheon at noon on Saturday, the 18th; and the Annual Banquet on Saturday evening, the 18th.

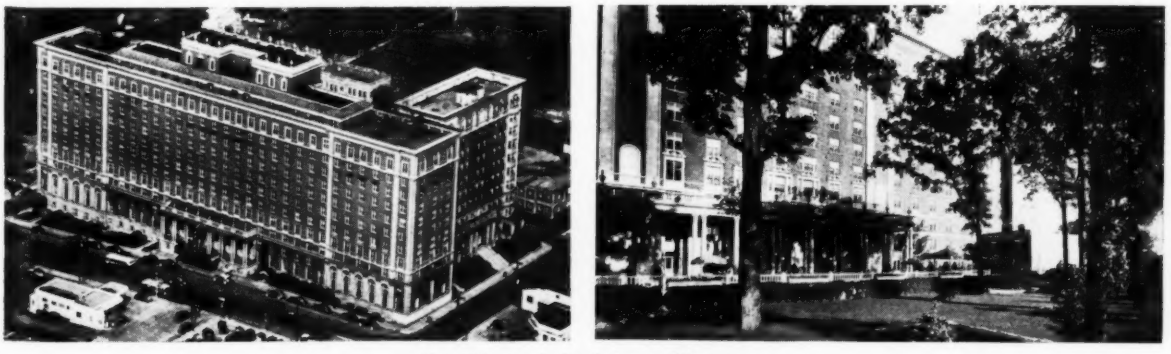
THE ANNUAL BANQUET, traditional finale of each year's Convention, will be held in the air-conditioned Exhibition Hall, and plans are being made to handle 2,000 members and guests.

THE OLNEY MEDAL LUNCHEON will be held at noon in the ballroom and Crystal Lounge, with officials from Corporate Members' firms in the South as honored guests. Members are urged to make early application for tickets to this Luncheon when returning advance registration forms.

Joe T Bohannon

THE ALUMNI LUNCHEON will be held at noon in the ballroom under the direction of Herman A Dickert, director of the A French Textile School, Georgia Institute of Technology. Arrangements will be made for group seating of all alumni and students from each of the textile schools represented.

THE FOOTBALL BUFFET LUNCHEON will be served from 12:30 to 2:00 PM in the Exhibition Hall prior to the football game between Tulane and Georgia Tech. All members will be given an opportunity for indicating how many tickets for the game they wish.



Two Views of the Atlanta Biltmore

Minutes——

191st COUNCIL MEETING

THE Council held its 191st meeting in the Hotel Dennis, Atlantic City, New Jersey, on Friday morning, April 30, 1954. Present were President J Robert Bonnar presiding; George L Baxter, Samuel L Hayes and Joseph H Jones, vice presidents; Albert E Sampson, treasurer; Leonard S Little, chairman of the Executive Committee on Research; William D Appel, Carl Z Draves, Henry F Herrman, C Norris Rabold, Thomas R Smith and P J Wood, past presidents; Elmer E Fickett and Sawyer F Sylvester representing Northern New England; Ernest J Chornyei, Raymond W Jacoby, Thorwald Larson and Edward W Lawrence representing Rhode Island; Raymond J Carey representing Western New England; Robert C Allison, Matthew J Babey, Charles W Dorn, Weldon G Helmus, Patrick J Kennedy, Paul J Luck, and Donald E Marnon representing New York; Carleton T Anderson, Edward C Diehl, Harry L Morgan, Ernest E Rettberg, Jr, Frederick V Traut and Jackson A Woodruff representing Philadelphia; Walter M Scott representing Washington; Arthur C Hayes, Harley Y Jennings and R Hobart Souther representing Piedmont; S Jack Davis and H Gillespie Smith representing Southeast; Joseph D Mosheim representing South Central; Arthur T Brainerd and Samuel Klein representing Mid-West; Kenneth H Barnard of the Committee on Conventions; Herman E Hager; William A Holst of the Committee on Constitution and Bylaws; George H Hotte; Glenn D Jackson Jr of the Publicity Committee; Thomas J Scanlon, secretary of the Philadelphia Section; Albert E Johnson of the Corporate Membership Committee; Louis R Mizell; Percival Theel of the Publications Committee; and Harold C Chapin and Richard R Frey of the secretary's office.

The secretary's report of the 190th Council meeting and financial report of March 31st, and the treasurer's report of April 6th, were accepted.

The election of William H Cady to honorary membership, and of William D Appel to receive the next Olney Medal Award, were announced.

Mr Little reported the appointment of Charles A Sylvester as assistant chairman of the Technical Committee on Research. Under William A Holst as chairman, the Quartermaster—Air Force Dye Survey is making progress on dyeing methods for the Armed Forces. In the current debate on flammability legislation the Association is confining its service to the test for classifying materials, without statement as to the line of demarcation between safe and unsafe. More Corporate Membership funds are badly needed to cover a budget in excess of present income. Mr Johnson discussed new publications to promote the raising of additional funds, including the sixth in a series of Research Bulletins, the Newsletter in the *Reporter* and the "Corporate Campaigner". There was discussion of possible competition between Corporate Membership solicitation and requests for outing prizes, but the Council voted against any action.

Professor Theel reported further effort by the Publications Committee to get papers edited more rapidly for the *Reporter*. Abstracts permitted other journals will continue to be limited to 500 words.

Mr Sampson reported receipt of the *Colour Index* financial statement from England for the year 1953, and showed a dummy of one of the volumes with proposed binding. Proofs are coming in and may be inspected at the offices of the Howes Publishing Company.

For the Atlanta Convention of September 15 to 18, Dr Scott outlined a three-day program in addition to the Intersectional Contest. Chairmen for the various divisions and some of the speakers have been selected. For the Perkin Centennial of 1956, Mr Jacoby reported that speakers have already been named by some of the co-operating associations, including an eminent British chemist who will speak on the life and work of Perkin. Plans for wide publicity are well under way. Mr Barnard reported plans for Atlantic City in 1955, and the selection of Ernest R Kaswell as Chairman of the Boston Convention under auspices of the three New England Sections in 1957.

For the Committee on Membership and Local Sections, Mr Hayes presented a petition for organization of a Western New York Section, which was approved, with appointment of Dr J E Lynn as secretary pro tem for the initial meeting. Each of the following was elected to the class of membership indicated:—

SECRETARY'S FINANCIAL REPORT—MARCH 31, 1954

	Applications	*Dues, Regular & Reinstate*	*Dues, Corporate & Sustaining*	*Miscellaneous*	*Totals*
Received and transmitted to Treasurer August 1 to December 31, 1953	2296.50	37759.50	29605.00	18255.52	87916.52
December 31, 1953 to March 31, 1954	1092.50	7262.75	16877.50	6077.25*	31310.00
Total in fiscal year to March 31,	3389.00	45022.25	46482.50	24332.77	119226.52
Leaving deposited by Treasurer with Secretary					3704.26
For comparison, receipts to March 26, 1953,	3768.00	43513.50	46507.50	9705.23	103494.23

* Miscellaneous items,

Dividends and interest,	484.75
Chicago convention, reimbursement for expenses,	648.26
Launder-Ometer royalties,	140.00
Grey scales,	54.50
Acceleroter liners,	145.00
Reporters and reprints,	55.85
Drycleaning kit,	2.00
Year Books,	595.55
Crockmeters,	884.91
Crock cloth,	205.91
Multifiber cloth royalties,	339.94
Moth cloth royalties,	42.50
Water test apparatus,	100.05
Dyed standards,	118.00
Knitted tubing,	16.40
Gas fading blueprints,	41.00
Flammability blueprints	1.00
Buttons,	4.50
Color transfer charts,	316.86
Analytical Methods,	169.15
Application of Vat Dyes,	1024.67
Cotton skeins, royalties,	20.45
Standard grease wool	45.00
American Viscose Scholarship,	621.00
	6077.25

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R E Brouillard
H W Burt
A B Campana
M C Chauvet
H B Childers
S Cicio
G A Collins
D G David
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E D Desmond
R H Dickinson
W N Dulaney
E R Eakins
H L Edwards
J W Ertel
P T Fernald
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W Postman
L O Puckett, Jr
F P Reed
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R F Roberts
W G Rogers
R Rordorf
S N Salemi
J M Salsbury
W J Sands
J R Savnik
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C F J Scherf
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G A Berkstresser III
D E Caramante
M B Comer
F H Gentle
B E Hand
J B Hawkins
J E Lancaster
B L Lefkoff
W L Marino
T K Matsumoto
S M Mueller
H K Partovi
R P Pecci
J A Perry
J J Wilson, Jr
R E Winn

Transferred from other classifications to Senior

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I W Feyler, Jr
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J L Neal
R A Pearson
F R Padula
W J Romaine
A Schiff
W M Segall
J M Sweeney
B E Therrien
D A Watson
F S Webster, Jr

Respectfully submitted
H C CHAPIN
Secretary

AATCC Monograph No. 2

"THE APPLICATION OF VAT DYES"

"The group of fifteen editors responsible for this monograph consists of a well-balanced cross-section of American industry concerned with the production, marketing and application of vat dyes. The AATCC is to be congratulated on the production of a comprehensive survey of American vat dyeing and printing practice which is the major theme of this application . . . the book will be useful as a work of reference at this side of the Atlantic and as a working manual for the American colorists for whom it was designed. . . . If a clear account of American practice is required . . . the enquirer *must* have access to this volume".—*JOURNAL OF THE TEXTILE INSTITUTE* (England).

"This monograph contains the work of many mill-experienced authors, plus good, sound chemical and application principles developed in the laboratories and mills enjoying AATCC membership. . . . This book puts between two covers much information that a dyer is constantly searching for. It is a good investment for any laboratory, dyehouse, or printshop."—*TEXTILE WORLD*.

". . . this monograph should be in the hands of every user of vat dyestuffs, every student and every teacher. The book is well indexed and includes valuable lists of equivalent trade names. It will certainly take its place as a standard book of reference".—*JOURNAL OF THE SOCIETY OF DYERS AND COLOURISTS* (England).

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THE USE OF METAL TUBES IN THE LAUNDER-OMETER FOR THE DYNAMIC ABSORPTION TEST*

GEORGE J MANDIKOS

AATCC Research Laboratories, Lowell Technological Institute, Lowell, Mass

INTRODUCTION

DURING World War II, the Army Quartermaster Corps conducted an extensive program for the development of suitable water-repellent garments. All aspects of water repellency were considered, including field testing of garments and testing of water-repellent finishes and fabrics. In this connection the dynamic absorption test was developed by the Quartermaster Corps *(1)* as a result of an investigation of the idea that flexing and rubbing action, sustained while a garment is being worn in the rain, materially affect the ability of a fabric to withstand wetting.

From work done by the Quartermaster Corps it was concluded that the principal cause of degradation in field use was *wet mechanical action,* induced alone or as part of the laundering process. It is believed by the Quartermaster Corps that the dynamic absorption test is the most sensitive one developed to date for:—

a) Determining the true hydrophobic properties of a fabric at any time (when new, after normal wear, after artificial degradation, or after any other treatment).

b) Determining the ultimate hydrophobic level which can be obtained from any particular water-repellent finish.

c) Ascertaining the uniformity of penetration of a finish through the fabric, i e, the difference between highly hydrophobic surfaces attached to the outer portions of the fabric and those finishes which are evenly distributed throughout the fabric.

The dynamic absorption test was included in various Army specifications and also in Federal Specification CCC-T-191a Supplement, 8 October, 1945. This original test method required the use of a 6-liter jar with hexagonal sides (Figure 1). This type of container soon became unavailable commercially and it was necessary to substitute one which could be readily procured. Comparative tests were conducted by the Quartermaster Research and Development Laboratories using a six-quart cylindrical jar (commonly called a "museum jar") (Figure 2) and the standard hexagonal jar to determine whether their shapes significantly affected the dynamic absorption values *(2)*. It was found that the two jars were interchangeable, and the commercially available cylindrical jar was recommended as the standard while the hexagonal jar was considered as its alternate.

G J Mandikos

Since AATCC adopted the Dynamic Immersion Absorption Test (70-52) as a Tentative Test in 1952 the Committee on Water Resistance of Fabrics has urged the Association to provide its members with a source of supply for the entire testing unit. The Committee suggested that the source for the necessary apparatus be AATCC itself or a reliable outside supplier. AATCC was unable to locate the specified apparatus commercially and believed the market for the item to be relatively small, thus making it not feasible economically to have it manufactured. Therefore, it became necessary to design an alternative test using existing apparatus that is readily available.

The author has proven experimentally that the use of the Launder-Ometer, employing the 8-inch metal tubes, produces results which agree very closely with those of the original test. This was made possible by selecting optimum conditions, such as volume of water, number of steel balls, and size of fabric. This test is now under consideration by the Committee as an alternative method.

CARL R BELLWOOD, *Chairman*
Committee on Water Resistance of Fabrics

Lately the manufacturer of the cylindrical ("museum") jar has discontinued making this item, reportedly because of lack of workers skilled in this type of work. Thus the problem of a suitable jar was renewed.

Since the AATCC adopted the dynamic absorption test in 1952 it has been concerned with locating a source for the necessary apparatus as a service to its members.

In the meantime comparative tests were made at the AATCC Research Laboratories between a 1-gal jar (commercially available on a motor-driven unit) and the original 6-liter hexagonal jar. There was an appreciable difference between results obtained with the two jars. Also, an attempt was made to find a manufacturer who would be willing to manufacture a metal container (with the specified dimensions), and preferably, the complete motorized unit. However, this idea was not economically feasible because it was believed that there would not be an adequate market for this item.

Since the specified apparatus could not be located commercially, it became necessary to look elsewhere for existing apparatus which was readily available. It was believed that the 8″ metal tubes (Figure 4) used in the Launder-Ometer would be suitable after determining the optimum conditions, such as volume of water and number of steel balls. A selection of the optimum conditions and a comparison with the standard apparatus constitute the major part of this report.

EXPERIMENTAL

TEST FABRICS —— Seven fabrics with different constructions and/or water-repellent finishes were selected as follows:

Sample	*Construction*	*Finish*
1	8.5-oz herringbone twill	renewable
2	8.5-oz herringbone twill	renewable
3	9.0-oz sateen	renewable
4	9.0-oz sateen	durable
5	6.0-oz poplin	renewable
6	6.0-oz poplin	durable
7	6.0-oz duck*	durable

* No. 7 was a nylon duck; Nos. 1-6 were cottons.

* Submitted to *Am Dyestuff Reptr* on April 28, 1954.

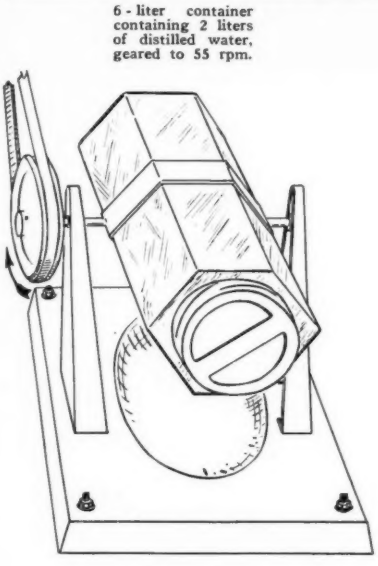

Figure 1
Original dynamic absorption apparatus.

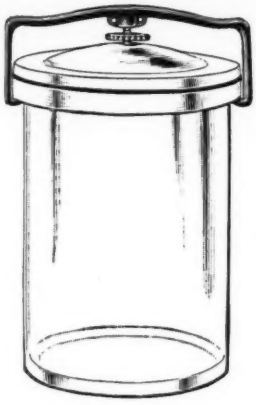

Figure 2
"Museum jar" substituted for hexagonal jar.

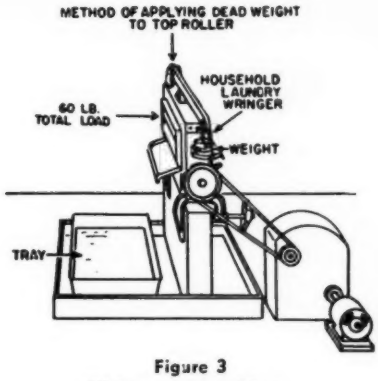

Figure 3
Wringer, motor-driven.

TABLE I

EFFECT OF WATER VOLUME ON PERCENT ABSORPTION IN LAUNDER-OMETER METAL TUBES

(without steel balls)

	*Dynamic Absorption—Percent**		
Volume	*1*	*2*	*Avg*
(ml)			
600	20.4	21.4	20.90
400	21.6	21.4	21.50
300	21.2	21.4	21.30
200	20.8	19.6	20.20
100	21.0	20.6	20.80

* Fabric No. 3—9-oz sateen, renewable finish. Average dynamic absorption value by regular method is 31.00%.

TABLE II

EFFECT OF NUMBER OF STEEL BALLS ON PERCENT ABSORPTION IN LAUNDER-OMETER METAL TUBES

(300 ml water)

	*Dynamic Absorption—Percent**		
No. of balls	*1*	*2*	*Avg*
250	31.5	29.6	30.55
200	30.0	30.7	30.35
150	30.3	28.6	29.45
100	27.7	27.9	27.80
50	26.0	24.4	25.20
0	21.2	21.4	21.30

* Fabric No. 3—9-oz sateen, renewable finish. Average dynamic absorption value by regular method is 31.00%.

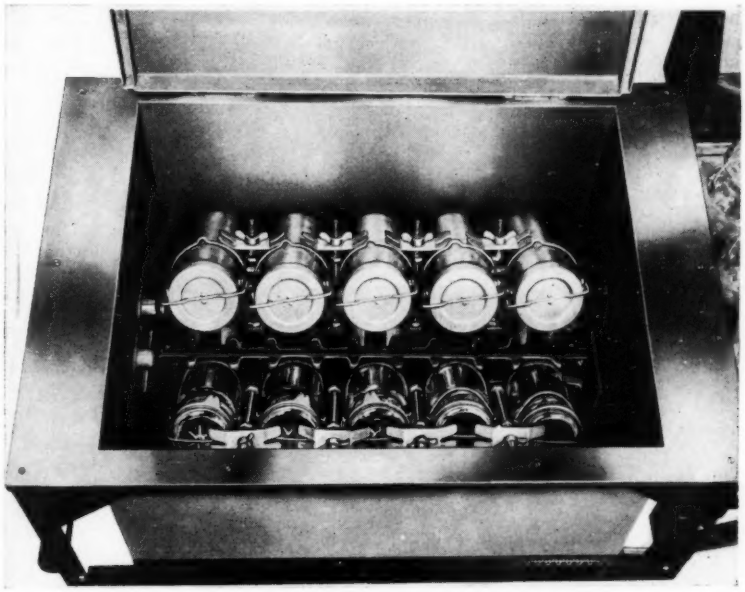

Figure 4
Metal tubes mounted in Launder-Ometer.

1. Regular Method

The procedure described in AATCC Tentative Test Method 70-52, pg 149 of *1953 Technical Manual and Year Book of the AATCC*, was followed (cf Method 5500, Federal Specification CCC-T-191b).

Apparatus and Materials

Dynamic Absorption Tester (Figure 1).

Wringer, motor-driven (Figure 3).

Laboratory balance accurate to 0.1 g.

Blotters, 10" x 10" ("White AATCC Blotting").

Distilled water at 80 ± 2°F.

Test Specimens

After conditioning the fabric samples overnight at 65 ± 2% r h and 70 ± 2°F, two sets (or "specimens") of five square pieces, each 8" x 8", were cut on a 45° bias.

Procedure

Place 2 liters of distilled water at 80 ± 2°F in the tumble jar. Roll together a set of five conditioned pieces (constituting a single specimen) and weigh to the nearest 0.1 g. Repeat with a second set of five pieces, using any suitable marks to differentiate the sets. Place both sets in the tumble jar, one piece at a time, and rotate the jar at 55 ± 2 rpm. After 20 minutes, remove the pieces of one set, one at a time, pass each piece through the wringer once without blotters at the rate of 1" per sec; then immediately pass it through the wringer between two unused blotters. Leave each piece

TABLE III

COMPARISON OF DYNAMIC ABSORPTION VALUES OBTAINED BY 6-LITER JAR AND LAUNDER-OMETER METAL TUBE

Dynamic Absorption—Percent

	6-Liter Jar					Launder-Ometer Metal Tube				
Fabric No.	*1*	*2*	*3*	*4*	*Avg*	*1*	*2*	*3*	*4*	*Avg*
1	46.5	50.0	49.2	49.9	48.90	46.8	46.4	43.2	43.5	44.98
2	40.1	44.0	45.7	45.4	43.80	44.6	45.4	42.8	42.2	43.80
3	31.9	28.3	31.6	32.2	31.00	30.0	30.7	29.8	28.4	29.73
4	18.2	19.5	20.1	20.4	19.55	21.4	21.7	19.8	19.7	20.65
5	27.8	29.3	31.1	29.1	29.33	32.2	33.4	28.3	28.5	30.60
6	18.4	16.4	17.6	17.9	17.58	19.4	19.0	20.4	19.8	19.65
7	6.0	6.3	3.2	2.6	4.53	7.6	6.9	4.1	4.6	5.80

TABLE IV

COMPARISON OF TEST SPECIFICATIONS BETWEEN REGULAR METHOD AND PROPOSED ALTERNATE METHOD

	Regular Method	*Alternate Method*
Dimensions of container (diameter)	12" x 6"	8" x 3½"
Volume of container (ml)	6000	1200
Volume of water (ml)	2000	300
Number of steel balls	—	200
Number of test pieces	10	10
Size of test pieces	8" x 8"	3" x 3"
Size of blotters	10" x 10"	5"x5"
Speed of rotation (rpm)	55	42
Time (min)	20	20
Temperature (°F)	80	80

between blotters until the five pieces from one set have been through the wringer; then roll the set of five pieces together and weigh quickly, protecting the pieces from air drying as much as possible during these operations. Repeat the above procedure for the second set of five pieces (second specimen).

Evaluation

The increase in weight for a specimen (five pieces) is divided by the original conditioned weight of the specimen and multiplied by 100 to obtain the percent of water absorbed. The values for the two specimens are averaged together and reported to the nearest 1.0 percent.

2. Proposed Alternate Method

This proposed alternate method makes use of the metal tubes in the Launder-Ometer.

Apparatus and Materials

Launder-Ometer (Figure 4).
Metal Tubes, 8" x 3½" dia. (Figure 4).
Steel balls, ¼".
Wringer, motor-driven (Figure 3).
Laboratory balance accurate to 0.1 g.
Blotters, 5" x 5" ("White AATCC Blotting").
Distilled water at 80 ± 2°F.

Test Specimens

Two sets of five square pieces, each 3" x 3", are cut on a 45° bias from conditioned fabric samples.

Procedure

Place 300 ml of distilled water at 80 ± 2°F and 200 steel balls into an 8" metal tube. Weigh each set of five pieces to the nearest 0.1 g and place both sets in the metal tube, one piece at a time. After running the test in the Launder-Ometer at 42 rpm for 20 minutes, remove the pieces of one set one at a time, pass each piece through the wringer at the rate of 1" per sec once without blotters and then between two blotters. Allow the pieces to remain between blotters until the five pieces from one set have been through the wringer. Then weigh the five pieces together. Repeat the procedure with the second set of five pieces.

Evaluation

As in the case of the regular method, the percent of water absorbed is calculated by dividing the increase in weight for a specimen (five pieces) by the original conditioned weight of the specimen and multiplying by 100. The average for the two specimens is reported to the nearest 1.0 percent.

DISCUSSION AND CONCLUSIONS

Tables I and II show results of some of the preliminary work performed to determine the optimum test conditions for the alternate test method proposed in this report. It can be seen from Table I that the volume of water used does not significantly affect the dynamic absorption value. However, as shown in Table II, the number of steel balls used is of great significance. It was also found that increased time of test produced greater dynamic absorption values as previously reported by other investigators *(2)*.

As a result of the preliminary work it was decided that optimum conditions with the use of the Launder-Ometer metal tube should include 300 ml of water and 200 steel balls. The sizes of test specimens and blotters were also found to be satisfactory as reported.

A comparison of dynamic absorption values obtained by the 6-liter jar and by the Launder-Ometer metal tube is made in Table III. It is quite evident that there is good agreement between the two sets of averages. This conclusion is substantiated by the statistical "F" and "t" tests*. The "F" values (at the 5% level) show no significant difference between the two methods in the case of five fabrics. "F" values for Fabrics Nos. 1 and 6 indicate significant differences but it is the author's belief that the differences are due chiefly to the typical variations encountered in the testing of textile materials.

The author feels that the Launder-Ometer tube method described in this report is suitable as an alternate method to AATCC Tentative Test Method 70-52 and has submitted it as such to the AATCC Research Committee on Water Resistance of Fabrics for their consideration.

The chief advantage of the proposed test is the availability of the test instrument. It is believed that most laboratories which would be concerned already own a Launder-Ometer.

Other advantages of the proposed method include saving in amounts of test fabric, blotters, and distilled water required. Although the importance of temperature has never been proven, it is easy to control the temperature in the Launder-Ometer while there is no control in the regular tumbler jar apparatus. Also, it is possible to run several tests in the Launder-Ometer while only one test at a time can be run in the Tumbler Jar Apparatus.

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* The "F" test was used to determine whether there was a greater difference between the two methods than between repeated tests in one method. The "t" test was used to judge whether the absorption values obtained in one method were significantly higher than those obtained in the other method.

Hudson-Mohawk Section——

THE OCCURRENCE, BEHAVIOR AND ELIMINATION OF STATIC ON TEXTILES*

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After explaining the mechanism by which charges of static electricity accumulate on textiles, especially on those that are hydrophobic, the author discusses their elimination by grounding, air ionization, humidification, and application of chemicals. The chemicals for this purpose can be divided into inorganic salts, nonionics, cationics, anionics, and ampholytes.

The selection and evaluation of chemical antistatic agents on yarns and fabrics by very simple laboratory procedures not involving the use of instruments is the most valuable part of the paper. It is also shown how precision methods can be used for the evaluation of antistatic agents and methods.

INTRODUCTION

ELECTROSTATICS is a word that has become increasingly familiar and disturbing to textile men. It is one of the less commonly understood fields associated with our general concepts of electricity. What we now identify as static electricity, or electricity at rest, was actually the first electrical phenomenon produced by man — having been noted by Thales, a Greek, in the sixth century B C when he rubbed amber with silk. The existence of electricity in motion, or current electricity, was not discovered until over twenty centuries later by Galvani, assisted by a defunct frog. Within a little more than one hundred years the production and control of current electricity has become an enormous influence in our development, while little has been done to mitigate the ancient nuisance that dirtied up with lint the amber beads of Thales.

In electrostatics we deal with attractive and repellent forces between charges existing on surfaces; like charges repelling each other and opposite charges attracting, much in the same manner as magnetic poles. These forces may be relatively powerful, and if the substance of a surface on which they are present is light in mass and mobile, motion of the substance occurs. If balanced on a frictionless pivot, a massive beam of lumber can actually be rotated by bringing a small charged rubber rod near one end. While this is of no particular importance to the lumber industry, these forces can be abomination to the textile man. These attractive or repellent forces may cause yarn ends to stick or tangle severely on machines; staple fibers may stick and lap on rolls and aprons or be repelled on cards causing web disintegration and excessive fly; lint, dust and soil can be attracted and adhere tenaciously to fabrics and carpets. Difficulty is often encountered in stacking, cutting and sewing charged fabrics, and troublesome clinging of garments to the body may also occur. Manufacturers, processors and handlers of other light, nonconductive articles, such as paper, plastic films and brush bristles, are similarly inconvenienced by static.

Aside from being strictly a nuisance, static can become a hazard when charges become great enough to cause electrical shock and to exceed the sparking potential of the surrounding air. Thorough precautions should necessarily be taken to avoid such spark discharges in explosive atmospheres or in the presence of combustible materials.

MECHANISM OF CHARGE DEVELOPMENT

Electrostatic charges are probably acquired rather easily and frequently by the surfaces of most substances but only under certain conditions do they assume active proportions. On an isolated mass of large area such as a cloud, static charges accumulate to the extent of producing lightning flashes. Fortunately, no synthetic fiber has yet been discovered that is capable of producing thunderbolts in a textile mill.

The manner in which electrostatic charges are acquired by surfaces is generally believed to be through a sequence of contact and separation. In the case of textiles this usually occurs as rubbing.

In their normal state, all substances are believed to be composed essentially of positively charged and neutral components in their atomic nuclei and negatively charged electrons in their atomic orbits. Although the positive nuclear components are equal in charge to the electrons — resulting in electrical neutrality — they are about 1800 times greater in mass than the electrons and relatively immobile. Some electrons on the other hand may be more or less free to move about within the atomic lattice under the influence of neighboring electrical charges. Substances which are generally regarded as electrical conductors, such as metals, are thought to be characterized by the presence of these "conduction electrons", while the electrons in nonconductors are thought to be held more rigidly.

Just what occurs when two surfaces are brought into intimate contact is probably not completely understood. One theory is that a few electrons are wiped off of one surface on to the other, and upon separation the surface having the excess electrons is found to be negatively charged, while the other surface, having

* Presented at the Hotel Johnstown in Johnstown, N Y, on Friday, Nov 13, 1953. The ms was rec'd by the Editor of Proceedings on Jan 6 and by Am Dyestuff Reptr on May 11, 1954.

lost some electrons, has acquired an equivalent positive charge.

It is known that, when two unlike surfaces are in contact, an electrical force known as the contact potential exists for the particular pair. It seems probable that this contact potential may influence the migration of a few electrons from one of the surfaces until the potential is neutralized within a double layer of opposing charges on the contacting surfaces. Upon separation, the surfaces then would exhibit equal and opposite charges depending on which one had gained or lost electrons. A number of electrostatic series of substances including textiles have been developed showing the positive-and-negative-charge relationships developed when any pair of the substances is placed in contact and then separated.

There is considerable evidence that the propensity of a substance to become electrostatically charged on contact is determined by its dielectric constant, also known as its specific inductive capacity. This term defines the susceptability of a substance to permeation by an electrostatic field and would determine the capacitance of a condenser employing the substance as a dielectric. It does not express the insulating characteristics nor the electrical resistivity of a substance. According to G W Graham *(1)*, the intensity of the contact potential and the subsequent charge produced depends upon the difference between the dielectric constants of the contacting surfaces. He further points out that a solid can have more than one dielectric constant, depending upon the crystal axis along which the measurement is taken, and thus he accounts for the development of a small charge on contact of polymeric substances, such as synthetic textile fibers, of the same chemical composition but slightly different degrees of orientation.

The behavior of static charges on surfaces depends to a large extent on whether the surface is essentially electrically conductive or nonconductive. On a conductive surface, a static charge becomes completely distributed and exhibits a pattern of concentration determined by the surface contours. If any part of a charged conductive surface is brought into contact with the ground, the earth immediately supplies or receives a sufficient number of electrons to restore the entire surface to an electrically neutral state. On a nonconductive surface, such as most textiles, charges remain substantially isolated at the points of accumulation. Thus, the effective discharging of an entire nonconductive surface can not be accomplished by grounding at any one point. A charge on either type of surface can induce an opposite charge on another nearby surface and thereby cause attraction.

The electrical properties of the medium surrounding charged surfaces, usually air, have considerable influence on the behavior of the charges. When this medium is nonconductive, as in the case of normal dry air, it acts simply as a completely contacting surface. As such it may set up a contact potential with a surface of unlike dielectric constant and produce charges, as in the case of air blown through glass capillaries. A gas such as air may be made electrically conductive within a limited area by ionization brought about by X rays, radioactive emission or high-frequency discharges. Both positively and negatively charged gas ions are thus produced, and either of these can migrate to an oppositely charged surface and render it electrostatically neutral.

Air can also function as a carrier of moisture. Since water has a relatively high dielectric constant, its presence on contacting surfaces may reduce the intensity of the contact potential and result in a reduced charge upon separation. In addition to this function, water is a reasonably good electrical conductor and to a limited extent can cause a nonconductive surface to exhibit some characteristic conductive properties, such as discharge by grounding.

If the atmospheric medium surrounding a charge surface contains particles such as water, part of the charge on the surface may be transferred to these particles thereby reducing the total charge on the surface.

DISCHARGE OF STATIC ELECTRICITY

Some of the acquired understanding of the origin and nature of electrostatic charges has led to the development of practical measures for the elimination or the controlled application of static electricity. Since in the textile industry we are concerned primarily with eliminating static electricity, its useful applications will be merely mentioned as including electrostatic dust and smoke precipitation, coating of surfaces with floc or other light particles, removing "tear marks" from freshly painted surfaces, removing lint from fabrics, and picking up sheets of gold leaf.

GROUNDING ——— As mentioned previously, the elimination of static electricity by grounding can be practiced successfully only where we are dealing with conductive surfaces. Thus the frames of machines can be connected to the ground by a low-resistance conductor and prevented from acquiring a charge powerful enough to be dangerous to personnel. Parts of machines thought to be grounded, however, may actually be insulated by films of oil in bearings. The grounding of the textile substance itself is much more difficult to accomplish even though it may have been rendered somewhat conductive. Grounded chains in contact with the moving fabric have been used with some success in reducing the charge on fabrics, but abrasion can be a serious disadvantage of such devices.

AIR IONIZATION———The use of air-ionizing static eliminators has become rather universal, but their effectiveness is limited to a small area of the textile substance. On high-speed processing machines, the amount of radioactive material necessary to eliminate strong static charges may exceed safe or practical limits. Both radioactive and certain types of high-frequency ionizing installations may actually cause a textile substance to become charged under some conditions. There is at least one type of high-voltage ionizing device available, however, which is reported to collect any ions produced in excess of those required to neutralize the charges on the textile and thus to avoid recharging.

Although grounding may reduce static charges and ionization may actually eliminate them, the textile substance can again become charged very rapidly on contact. This may even occur at another point on the same machine.

HUMIDIFICATION———It was previously described how moisture carried by air can assist in reducing static. The improved performance of textile materials under conditions of high relative humidity is common experience in mills. There are definite limits, however, to what may be accomplished by a high concentration of atmospheric moisture. In order for moisture to exert appreciable dielectric shielding and conductive effects it must remain on the textile surface. The conductivity of textile fibers has been shown by Murphy and Walker *(2)* and others to be directly dependent upon moisture content. However, the comparative conductivity and susceptibility of different fibers to the accumulation of static can not be explained entirely on the basis of their relative moisture-regain values. The presence of water in equivalent total amounts seems to have more influence on the cellulose fibers than it does on wool and some other protein types. This is explained by Murphy and Walker as being due to the assumption that the conductive paths formed by the water in the fiber are smaller in cross section in wool than in cotton and therefore result in higher resistivity at equal total

moisture contents. Thus the manner in which moisture is present in and on the fiber may have a considerable influence on the electrostatic properties. Although very high humidities are of unquestionable help, in order for water to act effectively on a hydrophobic fiber, it would have to be applied continuously in sufficient quantity to keep the surface from becoming dry by evaporation. The high humidities necessary in running hydrophobic fibers are very conducive to rusting and corrosion of machinery, are costly to maintain and are frequently uncomfortable to personnel.

Since grounding, air ionization and humidification are not entirely satisfactory methods of eliminating static charges, the remedy would seem to consist of rendering the surfaces of textile materials incapable of becoming or remaining appreciably charged on contact. This has been accomplished to a considerable extent by the development of chemical antistatic agents now available and in commercial use.

APPLICATION OF CHEMICAL AGENTS———The application of solutions of conductive hygroscopic inorganic salts to textile fibers will greatly increase their conductivity, but such salts are not suitable for general use. They are usually corrosive, abrasive, nonadhering or easily removed by water. The products that have been developed as textile antistatic agents are organic compounds of the surface-active class. Although more than one possible mechanism may exist to explain their antistatic properties, surface activity seems to be a primary requisite. This is probably attributable to the ability of surface-active compounds to become molecularly oriented on the fiber surface and thus both align themselves on the fiber and present a contacting surface which can exhibit some dielectric shielding and conductivity. In other words, the antistatic agents probably function in much the same manner as water, and since many of them are hygroscopic, their action may well be associated with the manner in which water is held by them and augmented in its natural antistatic functions.

NONIONICS———By applying a non-surface-active humectant compound, such as sorbitol, to the surface of a hydrophobic fiber, its moisture content can be detectably increased. A fiber such as nylon thus treated usually shows temporary antistatic properties, which diminish and disappear within a few days. When a surface-active derivative of sorbitol, such as Span* 20, which is sorbitan monolaurate, is applied to the fiber, a more pronounced and lasting antistatic effect is observed. Upon the addition of a long-chain hydrophilic group to the Span* 20, as is found in Tween* 20, still greater activity is obtained. Surface-active agents of the Span* and Tween* types are designated as nonionic compounds since they do not dissociate into ions when in aqueous solution. Other nonionic compounds which exhibit surface activity and varying degrees of antistatic action are the polyoxyethylene derivatives of fatty acids, fatty alcohols, cyclic alcohols, alkyl amines and amides and other hydroxy amino derivaties. The nonionic compounds have characteristically good stability in the presence of most other chemicals, and they do not adversely affect textile fibers or dye shades. They are available in a wide range of solubilities and consistencies, and many of these compounds also have useful lubricating and softening properties for textiles.

Since few or no free ions occur in solutions of the nonionic agents, they generally do not become as firmly attached to fiber surfaces as do ionizing-type compounds. Because of this they are usually removed to a considerable extent by washing. Although poor wash fastness can usually be expected with nonionics, it does not always occur. In U S Patent No. 2,628,176, Simon and Drelich describe the treatment of Saran with sorbitan monolaurate (Span* 20) to give it antistatic properties, which are resistant to a number of vigorous scrubbings with soap solution and a stiff brush.

From the nonionic group of compounds a number have been selected through co-operative research with the textile industry for commercial use as antistatic agents.

CATIONICS———Surface-active agents which dissociate in such a manner that the surface-active portion is positively charged are designated as cationic agents. These compounds generally have a more pronounced affinity, or substantivity, for the surfaces of fibers than the nonionics and therefore are most resistant to removal by washing. Cationic agents include such compounds as alkyl amine salts, quaternary ammonium compounds and other nitrogenous-base derivatives.

Many of the cationic compounds are very active and persistent antistatic agents. They are also usually found to be good textile softeners. Some cationic agents, although very active, are not suitable for general use on textiles because of skin-irritating and corrosion-promoting properties. An adverse effect on the light fastness of some dyes is also exhibited by certain cationics. These undesirable characteristics are usually encountered at relatively high concentrations and may not be a significant factor where very dilute solutions are employed. They should be given full consideration, however, before adopting an antistatic agent.

A number of cationic quaternary derivatives, including the alkyl morpholinium type, have been found to meet the antistatic requirements of certain specific textile processes.

ANIONICS———The third general class of surface-active agents consists of compounds in which the active portion of the molecule is found to be negatively charged on dissociation. These compounds are known as anionic agents. Some of the more common types are soaps, sulfuric esters and a wide variety of alkane and alkyl aromatic sulfonic acid derivatives. Some of the anionic agents show substantivity for certain textile fibers. A number of them are good softeners and they do not generally affect the fastness or shade of dyes. Although many of the anionics exhibit some antistatic properties, only relatively few of proprietary composition have been found to be highly effective on hydrophobic synthetic fibers.

ZWITTERIONICS———A fourth class of compounds exists in which the surface-active portion of the molecule may appear as either a positively or negatively charged ion upon dissociation, depending upon the pH of the medium. As a whole such a molecule forms what is known as a zwitterion, and surface-active agents of this type are called ampholytes. Some ampholytic compounds of the betaine type have been found to display antistatic activity.

It is well to know as much as possible about the basic surface-active properties and chemical type of an antistatic agent under consideration, since such information may help in predicting some of its other effects. In some cases the activity and general suitability of a product may be rather specific for a particular fiber, operating process and method of application.

Antistatic agents may be applied either directly or in combination with other textile auxiliaries to minimize processing operations. They are frequently incorporated into producer finishes, throwing and coning oils, lubricating and softening compounds, sizes, wool oils, etc. The amount of antistatic agent required to give the desired protection depends upon a number of factors such as the type and form of the fiber, activity of the agent, presence of other fibers in blends and relative humidity conditions. Concentrations deposited on the fiber of from about 0.05% to as high as 5% of the fiber weight are frequently employed.

* Trade-mark registered by Atlas Powder Co.

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SELECTION AND EVALUATION OF ANTISTATIC AGENTS

The classes of chemical compounds recognized as antistatic agents having been briefly considered, it is desirable to discuss some of the methods used for their selection and evaluation. Very simple comparative tests can be made or more complicated research procedures may be set up, but ultimately a number of the best performing products in such screening tests should be compared under similar conditions in the processes where they must be used.

TESTING WATER-SOLUBLE ANTISTATIC AGENTS———A simple test can be made on yarns by immersing small skeins into solutions or emulsions of different antistatic agents prepared at various selected concentrations. After the skeins are soaked for a specific time, say two minutes, they are removed from the bath and the excess liquid is removed by squeezing or centrifuging. The skeins should then be hot-air-dried. Upon removal from the drying oven, one end of a skein is immediately looped over a glass hook attached to a firm support, and the skein is pulled taut by another glass hook held in one hand. While thus tightly held, the skein is stroked vigorously a given number of times with a rod made of a material which normally produces a static charge on the yarn. Rods of glass, porcelain, hard rubber, various plastics or metal may be used. Metal rods should be provided with an insulated handle. After stroking the skein, the tension with which it is being held should be relaxed and its behavior noted. If a substantial static charge has been acquired, the yarns in the skein will snap out into a large baloon. If no charge is present, they will remain undisturbed and adjacent to each other. The degree to which the yarns are repelled can be used as an index to the effectiveness of the antistatic agent. When no disturbance of the skein is apparent, the rod with which it was rubbed should be brought very close to it to see if any attraction between it and any of the yarns exist. By making the rubbing test while the yarn is still very dry and then repeating it after the yarn has become conditioned to the prevailing humidity, the effect of moisture on the activity of the antistatic agent may be observed. Since the surface of the rod probably picks up a trace of antistatic agent from the yarn, it should be cleaned thoroughly in a solvent, such as a mixture of carbon tetrachloride and alcohol, between uses. The persistence of the antistatic activity may be observed by repeating the rubbing of skeins at intervals of a few days, weeks or months. After initial testing, skeins may be scoured and dried and the rubbing repeated to determine the wash fastness of the applied agents. It is of course advisable to include as control skeins of the yarn that have received no treatment and some that have been immersed in water in place of an antistatic agent. The relative humidity at which repeated tests on conditioned yarn are made must be kept at a uniform level in order to interpret the results significantly.

TESTING SOLVENT-SOLUBLE AGENTS———If the product to be tested is not intended for application from water, it may be applied from a volatile solvent. To do this, the skein is weighed and the amount of product which it is desired to apply is weighed into a small beaker. A small amount of solvent, such as ether, Freon, or petroleum ether, is placed in the beaker and is permitted to dissolve the antistatic product. The skein is then placed in the beaker and is worked in the solution until the solvent has evaporated. It is then air-dried and finally oven-dried.

TESTING AGENTS ON FABRICS ———One of the simplest methods of evaluating antistatic agents for fabrics is first to apply the agent either from water or solvent as in the case of skeins, to dry the fabric and then to test in the following manner: Place the piece of fabric on a nonconducting surface, and rub it vigorously with a piece of another type of fabric, which would normally give it a static charge. The piece of fabric being tested is then picked up by the edges with the fingers and slowly moved face downward toward a smooth surface, such as a sheet of paper on which have been placed some thoroughly disintegrated cigarette ashes. If the fabric is charged, it will attract the fine cigarette ashes while still well over an inch away from them. The smaller the charge, the closer the fabric can be brought to the ashes without attracting any. Antistatic persistence, wash fastness, etc may be observed on fabrics by this technique.

PRECISION MEASUREMENTS——— Both of the above described test methods are somewhat crude, but they can be performed without special equipment. For the more precise investigation of antistatic agents it is necessary to acquire some type of electrostatic voltmeter and preferably apparatus for mechanically producing the charging contact and separation sequence between textile surfaces. A number of portable meters designed to measure the intensity and sign of static charges are available. These instruments are very useful for locating and measuring sources of static accumulation. An excellent devise for laboratory study of static is described by Hayek and Chromey *(3)*. With this apparatus, controlled static generation is achieved, and measurements of charge intensity and rate of dissipation can be made with fabric samples. The apparatus developed by G W Graham *(1)* is also a very satisfactory device for the study of static on yarns. D J Lehmicke *(4)* has described the adaptation of the so-called "ice-pail" experiment of Faraday to the precise measurement of static electricity. The apparatus which he described consists simply of a metal beaker insulated from the ground and connected to the "high" terminal post of a vane-type electrostatic voltmeter. The charge on a sample is determined by dropping it into the beaker and reading the voltage on the meter. Of a number of static measuring devices in use at the Atlas Central Research Laboratory, this particular type is probably the most versatile because it can be used with fabric, yarn or staple fiber.

In addition to the determination of the activity, persistence and wash fastness of antistatic agents, attention must be given to other properties. One must consider whether they produce yellowing or affect dye shades, cause fiber degradation with loss of tensile strength, introduce undesirable drag, harshness or slipperiness, promote corrosion of machine parts, cause skin irritation, have an offensive odor, or react unfavorably with other chemical compounds used in processing. All of these factors together with numerous economic considerations must be taken into account in developing and in selecting antistatic products.

Through intensive research and with the valuable co-operation of the textile industry, chemical manufacturers are now making available a number of very satisfactory antistatic agents. While we do not yet have the solution to all static-elimination problems, our understanding of them and our techniques for attacking them are improving. We are confident that the result of this co-operative effort will be still better antistatic products in the future.

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Mid-West Section——

DYEING AND FINISHING "ORLON" ACRYLIC FIBER*

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With the current production of Type 42 "Orlon" acrylic fiber, the problem of dyeing "Orlon" has been considerably used. In the present paper the author not only discusses the application of various dye classes to this fiber alone with or without pressure, but he especially treats of the practical dyeing of "Orlon" in various forms, such as stock, package yarn, top, and different knitted textiles. The dyeing of blends of "Orlon" with wool and rayon is also fully explained. The paper ends with directions for bleaching "Orlon".

INTRODUCTION

In discussing the dyeing and finishing of "Orlon" acrylic fiber, my remarks will be confined to the new Type 42 fiber. Although it is realized that Type 41 "Orlon" is still in use, general emphasis is centered on the more readily dyeable Type 42 replacement.

Type 42 "Orlon" can be dyed in several forms and this discussion will include the dyeing of:

Stock
Top
Yarn
Sweaters and half hose
Fine-gauge jersey
Woolen and worsted blends
Rayon blends

DYES AND DYEING PROCEDURES

DYES——Because of improved dyeability, Type 42 fiber can be dyed with basic and disperse dyes as well as with acid dyes applied by the cuprous-ion technique. Contrary to experience with other fibers, which has emphasized the extremely poor fastness of basic colors, basic colors exhibit very good fastness on "Orlon" acrylic fiber, produce brilliant shades and present a number of most unusual cross-dyeing and union effects. Although many of the commonly available basic colors are deficient in fastness and some application properties, new dyes have been developed which form the nucleus of a new shade range having excellent wet fastness and good light fastness.

Many disperse dyes have good fastness to light and washing, and although they dye only to light shades, they are extremely level and uniform in dyeing.

A complete range of shades can be dyed with selected acid colors by the cuprous-ion method applied at the boil or at temperatures up to 230° F. However, because of the better dyeing properties of Type 42 "Orlon," dyeing techniques have to be altered to promote level dyeing.

STOCK DYEING——All three classes of color outlined above, ie, basic, disperse, and acid, can be applied to rawstock. However, primarily because of cost considerations, acid colors, applied by the cuprous-ion method, are most widely used for stock dyeing.

Acid colors can be applied either at the boil or at temperatures up to 230°F. In either case, stainless-steel equipment, preferably Type 316, is generally necessary to avoid corrosion. The commonly used reducing agents for the formation of the cuprous-ion from the cupric salts are

Hydroxylammonium sulfate
Sodium bisulfite
Combination of sodium bisulfite and glyoxal

Hydroxylammonium sulfate is generally used for atmospheric pressure dyeings; sodium bisulfite or a combination of sodium bisulfite and glyoxal, for application under pressure.

Care must be exercised to avoid unlevel results in dyeing rawstock with acid colors, either at the boil or at elevated temperatures. Because of the rapid rate of dye absorption, the colors must be properly selected, and physical, chemical, and thermal conditions must be controlled, since practically no transfer of acid dyes takes place once they have become fixed on the fiber. The range of useful colors is adequate, and a wide range of shades has been achieved on all of the commonly used types of machines.

With regard to color selection, it is necessary to choose acid dyestuffs that

1) Dye at a relatively slow rate
2) Will not precipitate under the conditions employed in the bath
3) Will not break down under these conditions

The following table shows a condensd list of colors having good application properties on Type 42 "Orlon" acrylic fiber.

Dye (2%)	*Light Fastness (Fade-Ometer Ratings)*
Quinoline Yellow PN	5-6
Du Pont Orange II	4-5
Du Pont Orange RO	4-5
Du Pont Neutral Brown BGL	7
"Roracyl" Orange R	7
Du Pont Crocein Scarlet N	4
"Pontacyl" Carmine 2G	4
"Pontacyl" Rubine R	4-5
Du Pont Anthraquinone Rubine R	5-6
"Pontacyl" Violet 6R	5
Du Pont Anthraquinone Violet 3RN	5
Du Pont Anthraquinone Iris R	7
Du Pont Anthraquinone Blue RXO	7
Du Pont Anthraquinone Blue SKY	7
Du Pont Anthraquinone Blue 3G	7
Du Pont Anthraquinone Blue RA	7
Du Pont Anthraquinone Blue AB	5
Du Pont Anthraquinone Green G	6
Du Pont Resorcin Brown 5G	7

In addition, two new offerings with good to excellent fastness properties — "Roracyl" Black N and "Roracyl" Navy Blue N — are being introduced for dyeing under pressure.

Along with color selection, retarding agents, such as Compound 8-S, "Alkanol" WXN, "Avitex" AD, "Emulphor" ON and "Triton" X-100, can be be used to slow down the dyeing rate. In atmospheric dyeings with hydroxylammonium sulfate, the addition of one to two per cent of sulfuric acid to give a pH of about 2 in the dye bath is effective in slowing down the rate of dyeing.

The most important physical factors which affect levelness are the method of loading the kier with stock and the rate of liquor flow. Since the stock will compact at temperatures above 180°F, bypassing or channeling with consequent unlevelness may take place during the dyeing cycle. This can be avoided by loading the stock hot, wet, and with even distribution. This is accomplished by filling the kier with water and raising the temperature to 200-205°F. The stock is

* Presented on Nov 7, 1953 at the Bismarck Hotel, Chicago, Ill. Ms received by the Editor of Proceedings on Nov 14, 1953, and by the Reporter on April 29, 1954.

then loaded evenly around the kier, and the water is dropped below the top level of the stock. Any soft spots or holes are filled in with a paddle. The stock should be somewhat higher and well packed around the sides of the kier. The top plate and cover are positioned, and the following dyeing procedure is carried out:

1) Fill kier with water and adjust temperature to 160°F.
2) Add dyes.
3) Add dissolved copper sulfate, acid, and any auxiliary chemicals; circulate 10 minutes.
4) * Add reducing agent.
5) Heat to 195°F at 2°/minute, hold 10 minutes.
6) Heat to 205°F at 1°/minute, run 10 minutes.
7) If dyeing at atmospheric pressure, run at 205-210°F for 30 to 60 minutes to exhaust the color. For high-temperature dyeing, proceed as follows:
8) Raise the temperature to 215°F at 1°/minute and hold for 10 minutes.
9) Raise temperature to 225 to 230°F at 1°/minute and hold for 30 to 60 minutes to exhaust the color.
10) Cool down, drop bath, rinse, scour, and finish as desired.

The quantities of copper sulfate required will vary with the depth of shade as indicated in the following table:

COPPER SULFATE HYDRATE FOR CUPROUS-ION METHOD

Depth of Shades	*% owf*
Light	1 to 2
Medium	3 to 4
Heavy	5 to 6

An exception to the above is "Roracyl" Black N, which requires 10-12% of copper sulfate hydrate depending on the concentration of color used.

The amount of reducing agent is based on the quantity of copper sulfate used. The following amounts are required per pound of copper sulfate hydrate:

Hydroxylammonium sulfate — 0.4-0.5 lb

Sodium bisulfite — 0.25 lb

Glyoxal-sodium bisulfite mixture — 0.25 lb Glyoxal + 0.25 lb bisulfite

When sodium bisulfite is used, 0.5 pounds of sodium nitrate per 100 lb of "Orlon" is used as a corrosion inhibitor in stainless-steel equipment.

Experience has shown that liquor-flow rate should be in the range of 1-4 gpm per pound of stock. Rates lower than those specified may result in heavy dyeing in the upper part of the cake, and excessive rates of flow may result in cake distortion and channeling.

For pastel shades, disperse colors are preferred for Type 42 "Orlon" rawstock. Carefully selected colors from this group produce dyeings having very good light fastness coupled with good wet-fastness properties. These colors are applied at atmospheric temperatures, since pressure operation does not appreciably increase their build-up. The disperse colors dye at a moderate rate and they transfer. The use of this class of dyes has almost uniformly resulted in level dyeings.

Under certain conditions, the basic colors are useful for dyeing raw-stock. Where pressurized equipment is not available, they possess advantages in some of the dark shades, such as navies, over the acid colors required at 212°F. However, basic dyeings are generally more expensive than similar shades produced with acid colors under pressure. The basic shades are brilliant, have good fastness to washing, crocking and perspiration and have light fastness generally suitable for women's wear and in dark shades for men's wear.

In the use of basic colors, the fastness of these dyestuffs to carbonizing on blends of "Orlon" with wool must be carefully considered. The three new types, Basic Yellow OL, Red 4G, and Blue OB, show little shade change when carbonized on a 50/50 blend with wool. The older types, such as Victoria Green and Fuchsine, will change shade on carbonizing. The shade can be brought back by a more extensive neutralization than normally employed without penalizing other fastness properties. The degree of neutralization is, of course, limited by the shade change of the wool.

Since stock dyeing removes the processing finish applied to "Orlon" during manufacture, reapplication of a finish is generally required for high-percentage blends. "Avitex" R, applied after scouring, is satisfactory for this purpose.

TOP DYEING———As in the case of stock dyeing, basic, disperse and acid colors are all useful for the top dyeing of Type 42 "Orlon" acrylic staple, and the selection will depend upon the type of equipment, fastness requirements and cost. Disperse colors are the most suitable for pastels because of their superior light fastness. In top dyeing, basics are finding wider use versus acid colors than is the case in stock dyeing for two reasons: First, pressurized top-dyeing equipment is not widespread in the industry, and it is not practical to convert existing machines to pressure operation. With atmospheric operation, basic colors show a cost advantage over acid colors in some important dark shades, and the basics have good light fastness in dark shades. Secondly, carbonizing is not a problem in worsted processing.

Initially, the application of acid colors to tops by the cuprous-ion method was a problem in respect to levelness. In the Frederics system, the top balls distorted badly, and in the Abbott machine holes were blown in the spool as the temperature was being raised and before the dyeing temperature was reached. Because of the channeling, unlevel dyeings resulted with the nontransferring acid colors.

This problem was satisfactorily solved by reducing the liquor flow for both systems of dyeing to the point where the pressure drop across the top was not sufficient to distort the balls or blow the spools. At this point the flow is still great enough to give an adequately high ratio of contact rate to rate of dye absorption with avoidance of inside-outside shade differences.

Flow reduction on the Fredericks machine can be accomplished by the installation of a gate valve between the discharge side of the pump and the spindle. Without any top on the spindle, an 18" head of water in the machine and the pump running, the pressure is reduced with the valve until no water is coming out of the holes in the top third of the spindle. On the Abbott machine, the flow is reduced by raising the cap about ¾ inch on the spindle so as to allow part of the liquor to flow through this opening rather than through the spool.

The acid-color dyeing principles and procedures for top are otherwise similar to those outlined for rawstock. The color selection is the same and the same controls are exercised over dyebath conditions.

"Avitex" R also serves as a satisfactory processing finish for top.

YARN DYEING———In the package dyeing of spun yarns of Type 42 "Orlon" acrylic fiber, the same principles of color selection and chemical procedures apply as in the case of rawstock and top. As package dyeing machines are generally readily convertible to pressure operation, worthwhile cost savings are thus possible and the range of applicable colors is enlarged. Levelness has not been a problem even in the application of acid colors by the cuprous-ion method. Five-eighth-inch or one-and-five-eighth-inch tubes, Franklin, or Davidson springs can all be used. Fairly tight packages are desirable since the yarn tends to relax and elongate somewhat in the bath.

As a knitting lubricant for dyed yarns, Napco 1100 R or paraffin-"Avitex" R are recommended. They are obtainable in disc form and can be applied in coning in the same way as paraffin.

SWEATERS AND HALF HOSE——— Disperse and basic colors are used almost

* In dyeing at atmospheric pressure, add the hydroxylammonium sulfate in three portions, the first at 160°F, the second at 195°F, and the third 15 minutes after reaching maximum temperature.

exclusively on "Orlon" knitwear, the former for pastels and the latter for darker shades. These dyestuffs give good all-around fastness for these end uses in a complete shade range. The colors level well, the methods are straightforward, and conventional paddle and rotary equipment can be employed without pressure.

Presetting before dyeing is not required or desirable. Sweaters or fabric strips are packed in bags with enough freedom to move. The goods to be dyed with basic dyes are first scoured in the paddle machine for 15 minutes at 180°F with

0.5 to 1% Emulphor ON

0.25 to 0.5% tetrasodium pyrophosphate

and are then dyed by the usual procedures. Following dyeing, the bath temperature should be reduced gradually by an overflow rinse to avoid setting wrinkles. Undue wrinkling of sweaters during extraction is also avoided by centrifuging for a maximum of two minutes. They can then be dried fairly rapidly in a tumble drier at 180°F.

Half hose are dyed in much the same way as sweaters with disperse and basic colors in conventional equipment. Preboarding is not necessary, extraction should be light, and they may be dried on a boarder with external hot air at 200°F.

FINE-GAUGE JERSEY———Fine-gauge jersey of "Orlon," particularly the 80/20 blend of "Orlon" and wool, has become very popular. From the same greige goods, light and dark heathers, tone-on-tone effects, solid colors over a broad shade range, and sharply contrasting cross-dye effects can be produced by piece dyeing.

Basic colors are used exclusively for dyeing the "Orlon" with a variety of acid colors on the wool. Best results will be obtained in closed becks equipped with overhead steam lines so as to maintain temperatures as near 212°F as possible. Generally, a one-bath two-step method is used for dyeing the blend fabric. In dyeing light shades with basic colors in the presence of Du Pont Retarder LAN on the "Orlon" and "Capracyl"-type colors on the wool, a two-bath procedure is usually employed.

When light to light medium shades are desired, a leveling agent is needed to counteract the great affinity of the basic dyes. Du Pont Retarder LAN is particularly useful. For pastel to light shades, 2 to 3% Du Pont Retarder LAN owf is recommended; for light to light medium shades, 1 to 2% should be used. The agent has no adverse effect on the fastness properties of the recommended basic dyes.

In the one-bath procedure, the wool component is dyed first at a temperature of 180°F, acetic acid being added when necessary to exhaust the color. The basic dyes are then introduced at 180°F, the bath is heated to the boil, and is held at the boil for 1 to 2 hours to exhaust the color. Included in the dyebath are

0.3% sodium acetate

3-4% acetic acid

1% Emulphor ON

The sodium acetate is used to avoid an indicator type of change of certain of the basic colors, and the acetic acid and Emulphor ON minimize staining of the wool. During the boiling period, the basic dyes transfer from the wool to the "Orlon." It is generally desirable to boil one-half hour after the color has been exhausted from the bath to insure this transfer of basic dyes. In the application of chrome colors on the wool, chroming can be carried out in the same bath.

In dyeing an "Orlon"-wool blend by a two bath method, the "Orlon" may be dyed first in a fresh bath with the "Capracyl" colors. It should be emphasized that an aliphatic, nonionic dyeing assistant, such as Emulphor ON, must be used for reserving the wool. Most commercially available nonionic surfactants contain aromatic groups, which will allow considerable staining of the wool. The wool is then brought to shade in a fresh bath.

The scouring of an "Orlon"-wool blend after dyeing by any of one-bath or two-bath methods is carried out in a fresh bath for 15-20 minutes at 160°F with 1% Emulphor ON and 0.3% acetic acid owf. The detergent and acid help remove any basic color from the wool if basic dyes were used, and the acid prevents wash-down of the acid colors from the wool.

Dyed knit goods can be dried on a Tubetex drier or on a stack drier after centrifuging. The extracted material should be dried as soon as possible at a relatively low temperature to insure even application of heat to the circular knit goods. Final finishing is preferably done on an overfed machine with the steam shut off the calendering rolls.

WOOLEN AND WORSTED BLENDS———Woolen and worsted blends are dyed by the same procedures discussed for the 80/20 "Orlon"/wool jersey fabrics. However, usually these blends contain approximately 50% wool, and with the larger percentage of wool, it is sometimes desirable to use the two-bath method to establish the shade, particularly in dyeing solid union shades. After the shade has been established, the one-bath two-step procedure outlined above can be used.

RAYON BLENDS———"Orlon"/rayon blends can be dyed satisfactorily over a wide range of shades. Color selection for the "Orlon" is dependent upon the depth of shade desired. For pastel shades, selected acetate colors are applied on the "Orlon"; for medium shades, basic colors; and acid colors for the heavier shades applied by the copperion method.

For light pastels a two-step one-bath procedure can be used. The "Orlon" is dyed first with selected disperse dyes, and the rayon is then dyed with direct colors in the same bath, the color being exhausted with anhydrous sodium sulfate. On light to medium shades, a one-bath procedure can be used if the rayon is left essentially clear after dyeing the "Orlon." This will generally be the case in the lighter shades. In the heavier shades, the rayon will generally have to be scoured after dyeing the "Orlon." A twenty-minute scour with a detergent at 180°F is generally sufficient to clear the rayon. If the rayon does not clear with this treatment, the bath should be cooled back to 120°F, and 2 grams/liter of sodium hydrosulfite is added. After a thorough rinsing, the rayon can be dyed by the usual procedures.

In dyeing heavy shades by the copperion procedure, the "Orlon" is dyed first and then scoured with a detergent and a sequestering agent. In dyeing the rayon, the pH of the bath is adjusted to 8 with soda ash, and the rayon is dyed with directs selected on the basis of minimum stain on the "Orlon." A sequestering agent is also used in the direct-color bath to improve color build-up.

BLEACHING

Type 42 "Orlon" can be bleached by treatment for one hour at 180°F with the following:

1.5 grams/liter "Textone"

1.0 grams/liter nitric acid

Although the material bleached by this process has good wash fastness, the light fastness is only fair. An appreciable dulling occurs on five hours' Fade-Ometer exposure. A less brilliant but more durable white is obtained by treatment at the boil for thirty minutes with one gram of acid per liter (about 13 oz. per 100 gal.), either crystalline oxalic acid or 70% hydroxyacetic acid.

Of the two acids, hydroxyacetic acid is preferred since it is less corrosive.

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STABILIZING VISCOSE FABRICS*

L LESLIE WALMSLEY

American Viscose Corp, Marcus Hook, Pa

The shrinkage of viscose-rayon fabrics can be divided into two steps: the initial and the progressive. Experience has shown that a total of 5 (sometimes 10) consecutive washings etc at the boil gives a shrinkage that is equivalent to the shrinkage from 100 or so ordinary washings at 160°F or under.

But if a viscose fabric is to be stabilized, it must at the same time possess other requirements to meet the needs of practical use: color fastness, cloth durability to repeated washing, minimum chlorine retention (chloramine formation causes tendering), and suitable hand. The author explains six methods for stabilization and discusses each.

Although knit goods have not been stabilized extensively up to the present, it is predicted that knit goods of other fibers and blends will be stabilized to extend the usefulness of such materials. In drying and curing, knit fabrics are subjected to compressive shrinkage and relaxation.

INTRODUCTION

THE progress and development of durable finishes for rayon have a comparatively recent history; and the success of spun rayon, in particular in outerwear textiles, owes much to the efforts of the chemical industry in this respect. Most of these developments have been dedicated to improving the hand also that greater variations could be obtained in making the fabrics so treated crease-resistant or durably water repellent. The singular omission was the fact that there was no successful development of permanent stability. It can be said without fear of contradiction that the emphasis today is on washable fabrics. This is no doubt due in part to the development of the automatic home washing machine, but some of the responsibility must rest with the past poor performance of viscose fabrics in this respect. As recently as ten years ago almost all rayon fabrics were dry-cleanable only or were to be washed under restricted condition, and the fabric manufacturer or the converter was not considered responsible for poor shrinkage results on garments which were washed. The demand for rayon fabrics, however, was so great that this defect was not considered serious. As the field for rayon fabrics widened, the need for variation in finishes became greater, finishes which would provide greater consumer acceptance. The development of the resin processes provided a great impetus to rayon textiles, as by this process fabrics were made crease-resistant and the hand could be varied from soft to crisp. This process further added more weight to the fabric, and, in addition, to all of these qualities there was some measure of shrinkage control depending on the care which the finisher exercised. These crease-resistant finishes were and are in addition quite durable, if the garments are handled carefully during the cleaning or washing cycles. A great deal of development work was done to vary the resin process so that, where durable washability was of prime importance, this quality could be given. It was soon realized that the line of demarcation between crease-resistant finishes and those of shrinkage control was quite marked, in fact, some of the chemicals used to obtain crease resistance would be actually harmful or dangerous if used to obtain primarily shrinkage control under certain conditions of washing. The search then began for new processes which had as their primary function that of permanent shrinkage control. As a result, today we have those finishes which are essentially crease-resistant in character and those finishes which are basically shrink-resistant. It is the latter that I propose to discuss.

L L Walmsley

TESTING SHRINKAGE STABILITY

What is meant by a washable garment? A washable garment is one which, when washed under normal home-laundry or commercial-laundry conditions, will retain essentially its original measurements during and for the life of the garment, and its colors as well should be satisfactory for the same length of time. To be more specific, a washable rayon garment should not shrink initially and progressively more than a total of 2 to 2.5% when washed repeatedly at the boil. In order to explain, the shrinkage of a fabric at the first wash is called *initial shrinkage*. Any additional shrinkage in subsequent washes is called *progressive shrinkage*.

If a test were to be made on each washable rayon fabric to prove this point, it would seem necessary to test-wash until the fabric was worn out. Since this would involve up to one hundred or more washes, depending on the type of fabric, it can be seen that this would be entirely impractical. By experience, the various test laboratories have found that five consecutive washings using the CCC-T-191a procedure to be entirely satisfactory, and no useful purpose is gained by doing more. The procedure for the CCC-T-191a is as follows: start the washing cycle at the boil, boil for 40 minutes, followed by three 5-minute rinsings at 140°F. The fabric is then extracted and press-dried. If, however, during this washing cycle a fabric shows more than normal progressive shrinkage, it may be of value to take it up to ten. This is seldom necessary.

In view of the fact that the majority of garments are washed at temperatures not exceeding 160°F it would seem that the boiling wash test would be too drastic. However, it has been proven over and over again that washes at temperatures of 120 to 160°F may show satisfactory results in the first few washings but may show progressive shrinkage in continued washing, whereas, the boiling wash test will very rarely show progressive shrinkage after the first three washes. A boiling wash test may then be thought of as an accelerated test. Further, this test protects the ultimate consumer in every contingency of washing, and the label for washing does not have to hide behind restrictive conditions.

* Presented on Nov 7, 1953 at the Bismarck Hotel, Chicago, Ill. Ms received by the Editor of Proceedings on Oct 18, 1953 and by the Reporter on April 29, 1954.

REQUIREMENTS FOR STABILIZED WASHABLE RAYONS

WASHABLE COLORS———There are several implications in a stabilized material marked washable. It is implied that the colors, where colored material is involved, will satisfactorily stand the repeated washings involved in the normal life of a garment. This requires some attention. Currently the majority of spun-rayon and filament-rayon fabrics are dyed with direct colors, whether they are dyed in the piece, yarn or stock form. Very few of these dyes will stand repeated washings at 160°F without bleeding. In addition, the current shades for sport shirts and slacks in solid colors are dark, such as maroons, bottle greens, navies and dark browns. If these are dyed with directs, there is great danger that the color will subsequently wash down considerably, and if a white trim is used, there is danger of bleeding onto the white. In the case of yarn or stock dye where the majority of these fabrics are in plaids or stripes and where there are large white areas adjacent to dark colored areas, the danger of dyeing with direct colors becomes very great.

If possible, vats and naphtols should be used for washable garments. It is recognized that the use of blends of rayon with wool, acetate, nylon, or the newer synthetics complicates the problem, for, even though it may be possible to dye the fibers other than rayon are usually not of sufficient fastness to pass exhaustive wash tests. There are other instances where the use of vat colors is extremely difficult, such as in circular knitted materials; in cases like this, a very careful selection of direct colors should be made.

The direct colors spoken of are always of the copper or copper-salt-aftertreated type, and, as is well known, the aftertreatment is quite often applied during the finishing process and may be incorporated in the finish. This lessens the amount of time needed for aftertreatment during dyeing and improves the fastness qualities of the dyes so treated, particularly to washing. Some of the newer fixatives with selected direct dyestuffs give fairly satisfactory results when washed under the AATCC, test 3 for five consecutive washings, there being very little staining of the white and no noticeable loss in shade. In addition, some of these dyes show very little fading at 80 hours. The selection must be careful, however, as in the case of all dyestuffs there are no general types which have all the same properties. In any case, the fastness of the color is very definitely implied in a garment marked washable.

WEAR RESISTANCE———The term "washable fabric" very definitely implies that the garment is so made that it will last a reasonable length of time without showing holes or tears or fraying, and it is at this point that the wet strength of material is involved. The process used for imparting stability should not adversely affect the wet strength and should, if possible, retain the original wet strength throughout repeated washings. This is one major factor which has been overlooked in the rayon industry. It is not the original wet strength which is of importance if measured in terms of the life of the garment, but continued wet strength. Most strength tests are measured in terms of the dry strength after one wash. In evaluating the properties of a finish or a fabric this is totally in error. It has been demonstrated many times that a fabric may have a very high initial wet and dry strength, but, during the washing cycles, the strength both wet and dry — but especially wet — degrades quite rapidly, so that after as little as 10 washes the wet strength may be dangerously low and result in holes and tears. This is particularly important in the case of rayon where the wet strength is much lower than the dry strength. Untreated fabrics will degrade rather rapidly on continued washing. However, since almost all fabrics today are treated in some manner, it is a matter of the utmost importance to select those finishes which will most nearly maintain the wet strength of the material throughout continued washing.

FREEDOM FROM CHLORINE RETENTION———The finish for stabilizing a rayon fabric marked washable should not be chlorine retentive. As a general rule, dyed fabrics are not given chlorine treatments, and so the danger of chlorine retention is not present. However, unless specifically marked, the implication of a label for washability does not eliminate the use of chlorine where needed, for instance, in white fabrics, ladies' printed dresses, children's wear or printed table cloths. It is well known that the use of antichlors will eliminate the possibility of chlorine retention. However, this is not normally done in home laundering and is not accepted by the commercial laundries as normal procedure. It is a matter of discretion on the part of the individual laundry. Further, in this respect, the new type of home bleaches are gaining popularity, and the basis of these home bleaches is sodium perborate, with which there is no danger of chlorine retention even for those finishes that are chlorine retentive. It will not be known for sometime after all these new finishes have been on the market, just what the implications of nonchlorine retention means. It would seem safer, however, where there is a choice, to make sure that there is no danger of the development of chlorine retention.

MAINTENANCE OF HAND ——— The process of stabilizing washable garments should have sufficient latitude to allow for varying hand, and the hand imparted by the process should be essentially retained throughout the life of the garment. In addition to imparting a hand, the new finishes should be such that other properties can be imparted in a desirable degree, like water repellency, abrasion resistance and tear strength. The addition of extra chemicals to gain these properties, however, may involve complications in the appraisal of the final results. Some of the benefits obtained by the original finish may even be impaired when chemicals are added to import other properties. For example, the addition of water repellents of a durable type usually causes a lowering of the original tensile strength, while improving tear strength and abrasion. Also, the addition of color fixatives may tend to lower tensile strength with certain processes, and, in almost all cases, will introduce chlorine retention even where there was none before. The benefits of improved color fastness to light and washing, however, may be more important than increased chlorine retention. Examples of firm and soft hands are on exhibition and may be seen at the end of the lecture.

MINIMUM PROCESSING LOSS——— The process should be such that there is no undue loss in fabric weight from greige to finished goods. It would be impractical to use a finishing process that involves undue processing loss. Some processes that have been developed in the past, such as those for relaxation and compression, were usually unsatisfactory because of large processing losses. In any such processing there is always the possibility of growth, and thus, in any stabilizing procedure, both shrinkage and growth must be controlled.

To repeat, a completely washable garment should meet the following requirements in addition to shrinkage control:

1) color fastness
2) durability to repeated washing
3) minimum chlorine retention
4) suitability of hand
5) minimum working loss

METHODS FOR STABILIZING VISCOSE FABRICS

At this point it might be of interest to state how stabilization such as has

been described may be obtained. The following represent the major methods, most of which are in active operation currently:

1) the Definizing process
2) the acid-formaldehyde process
3) the glyoxal process
4) the X-2 process
5) the cellulose-ether/formaldehyde process
6) the modified-resin process

DEFINIZING PROCESS———(1) The Definizing process involves treatment with approximately 30% caustic soda at room temperatures, after which the fabric is exposed to the air or skyed for a definite length of time and then neutralized in sulfuric acid with sodium bicarbonate as a buffer. The use of sodium bicarbonate has also been recommended as a neutralizing agent. Many thousands of yards of satisfactory fabric have been so processed; however, because of the difficulties of control and the possibility of tender goods, this process has not enjoyed too much popularity. In addition, the machinery required would not be suitable for the processing of other types of merchandise, and the average plant is reluctant to spend a great deal of money for equipment where the finish is not in great demand.

ACID-FORMALDEHYDE PROCESS ———(2) The acid-formaldehyde process has not been popular because of the hazards of control, and it was found by experience that, unless there was exceptional control, either tender goods or poor stability resulted. This was a hazard which the average finisher was not prepared to accept.

GLYOXAL ——— (3) The glyoxal process consists primarily of padding onto the goods approximately 4½ to 10% of glyoxal, 2 to 12% of resin, ½% of softener, and enough sodium sulfate and sodium bisulfate to serve as buffered catalysts. The process has been quite successful; however, the use of resins in the process would indicate that chlorine retention might be a problem. It is stated by the users of this process, however, that chlorine retention has never become a problem. Excellent variations in hand may be obtained by this process, and the control of the finish is satisfactory. Samples of this finish are displayed for inspection at the end of the lecture.

X-2 PROCESS———(4) The X-2 process is a trade-mark of the Dan River Mills and is composed of the X-2 chemical and a nonchlorine-retentive resin. Approximately 2 to 8% of X-2 is used and 2 to 6% of resin, depending on the hand desired; softeners and starches may be added where necessary. The conditions of curing in this process are somewhat higher than normal, being 330° to 380°F for 2 to 10 minutes, depending on conditions and the cloth. The stability is satisfactory and adds some measure of crease resistance. In addition, it is said not to be chlorine retentive and to add longer life to the fabric.

CELLULOSE ETHER———(5) The cellulose-ether process involves the use of hydroxyethylcellulose with 10% formaldehyde, with sodium bisulfate as a catalyst and with sodium sulfate as a buffer. Firming agents may be added as well as durable water repellents; copper dye fixatives may also be made part of the formula. This process gives excellent stability without chlorine retention and also increases the wear life of the garment. The working loss by this process is approximately 5 to 6% from greige to finished goods and may be lower if desired.

MODIFIED-RESIN FINISHES ——— (6) Modified resins, as the name implies, are resins of either urea or melamine and are said to be reactants. The resin is said to cross-link with the fiber and so create a strong bond between the resin and the fiber. Because these finishes contain nitrogen, they are chlorine retentive. The stability is excellent depending on the skill of the finisher. As in the case of normal resins, modified-resin finishes lend themselves to improper processing. For example, the amounts of material may be cut down, certain essential steps, such as drying and curing may be telescoped into one operation, and proper washing may be slighted or eliminated. Because of actions like these to cheapen the process, fabrics have been known with initial shrinkage in excess of 3% as well as progressive shrinkages in excess of 2%.

The cellulose-ether process, the X-2 process, the modified-resin process and the glyoxal process are all carried out by padding viscose-rayon piece goods with a solution characteristic of each process, drying to a specified finish width, curing, washing and redrying. Usually the drying temperatures are approximately 260° F, and no special care is used to keep the cloth relaxed in the drying. Curing is usually conducted at 300 to 320°F for 5 to 6 minutes, depending on the process except in the case of X-2. Curing is followed by washing and redrying to the finished width.

STABILIZATION OF KNIT GOODS

Almost all that has been said so far has dealt with the use of woven goods or the use of woven goods has been implied. This is primarily because the woven-goods field has demended these specifications as a requisite to selling. The knit-goods field has not been so demanding, and surprisingly poor stability acceptance is common practice in this industry. This must be because a knit garment is made loose-fitting, and thus shrinkage is not so important a factor, as for example, with ladies, nightgowns and underwear and men's tee shirts. The knit-goods industry is now attempting to make garments suitable for outerwear, such as sport shirts and washable women's dresses, items for which it is found that shrinkage is definitely a factor. For this and other reasons there has been increasing interest in stabilizing knitted fabrics. In the cotton-knit-goods field, this has been made possible by the use of both the Redman process and the use of the Tubetex Tensionless Calendar and Dryer, which permit compressive shrinkage and relaxation. These methods have been used also for woolens that have been treated first to be made nonfelting, whether by a process involving chlorine or resin, and then relaxed or compressed by either of the above mentioned processes. The stabilization of rayon knit-goods and knit-goods made from blends of rayon with other fibers may also be accomplished by the chemical methods previously described together with either the Redman or the Tubetex process.

There are two drawbacks to the acceptance of these methods by the finishing trade: 1) most knit-goods finishing plants are not equipped with the necessary machinery, such as padders and curing ranges, and 2) the cost of these processes is apt to be more than the dyeing cost. The customers of the knit-goods finisher will not willingly pay the necessary cost for improved stability, which up to date they have gotten along without, and the finishing trade is not easily persuaded to spend money for a doubtful venture, especially when the necessary equipment cannot be put to other uses. It is my opinion that stabilization of knit goods will nevertheless come about in due course. Over the past several years the number of tricot knitting machines has increased at a very rapid rate to take care of expanded demands. Lately there has been strong evidence that the market is contracting. The inevitable pressure resulting from this idleness of expensive machines will promote a search for new end uses for knit merchandise. If stability were added to the other desirable qualities of viscose tricot, a number of new markets would be opened. This field will probably be thoroughly explored in the very near future; in fact, several research projects have already been initiated.

CONCLUSION

It can thus be seen that there is a varied selection of permanently washable finishes on the market, which can be selected to fit the needs of the customer. Some finishes imply the guarantee of their name. By this is meant that every measure is taken (by those whose trade-mark it is) to see that each fabric is as the label states. The choice of the finish may be determined by the price of the chemicals involved, which vary considerably. Even though the over-all process may be roughly the same, the difference in chemical cost between two washable-type finishes may be very great and in the course of a year's operation will amount to considerable sums of money. The choice of a finish may depend upon the hand or texture of the fabric desired, although in this respect almost all of these finishes have sufficient variation in hand that there is a wide choice for each finish. The selection may be based upon knowledge of whether or not chlorine retention is a problem; or again the selection may be that one finish would seem to give longer life to the fabric than another. It should ever be kept in mind that a garment marked washable should be exactly that with no "ifs", "ands" or "buts" and with no reservations. When this becomes the the rule for washable rayons, the market will become unlimited, and both the rayon manufacturers as well as the fabric manufacturers can enjoy the satisfaction of a job well done.

REPORTS FROM LOCAL SECTIONS

PNW Meeting Report

A REGULAR meeting of the Pacific Northwest Section attracted 32 members to Portland, Oregon on May 14th for a visit to the plant of the Pennsylvania Salt Manufacturing Co during the afternoon.

During the evening meeting in the Marine Room of the Multnomah Hotel, a committee to be headed by Russ Koenig was appointed for the preparation of a paper on the effect of neutral dyeing on wool. The following committee was appointed to arrange details for the forthcoming Section outing at the Mt Hood Golf Club on July 24: J L Ayres, H C Osborn and F H Ihlenburg.

Western New England

A MOST successful "Ladies Night" meeting of the Western New England Section was held in the Saratoga Room of the Waverly Inn, Cheshire, Connecticut, on May 14, 1954.

The technical program consisted of a talk by Sidney M Edelstein, president and technical director of Dexter Chemical Corporation, on "Why The Fuss Over Static Electricity".

Music and dancing were enjoyed by all until 1:00 A M.

Approximately 100 members and guests were present.

WNE Ladies Night

Fairleigh Dickinson College

AT THE last meeting of the school year, the Fairleigh Dickinson College Student Chapter, which now numbers 22 members, elected Michael Marriott chairman, and Martin Samwick, treasurer. It was decided to select the secretary from students of the freshman class next fall.

Mr Marriott succeeds to the chair James Polito, who on May 6th was presented with one of the 1954 AATCC Student Awards. The presentation was made by H R Mauersberger, director of the College's Textile Department, during the Annual Textile Conference of New Jersey high school students.

(Photos by A N Henschel)

NOTICE TO AUTHORS OF PAPERS

MANUSCRIPTS for the *Proceedings* and for other publications of the American Association of Textile Chemists and Colorists shall conform to the requirements and standards given in this *Notice*. Before publication, manuscripts for the *Proceedings* shall be approved by the Editor, not only for editorial correctness according to the standards of this *Notice*, but also for content of technical matter. In his work, the Editor may enlist the aid of anonymous reviewers who are selected for expert knowledge in particular fields.

It is presumed that authors in studying the comments of reviewers and of the Editor will remember that all recommendations are made in a kindly, helpful, sympathetic manner to improve the paper in both literary and technical excellence. Although authors should cheerfully consider suggestions, they are expected to defend their position if justified, especially when strictly technical matters are involved with which the authors have an intimate knowledge.

MANUSCRIPTS—Manuscripts shall be typewritten double-spaced with approximately one-inch margins on 8.5 x 11-inch white paper. In addition to the *original*, at least one carbon copy is required. Pages are to be numbered consecutively with Arabic numerals, and each page after the first shall carry the authorship at the very top. Tables and figures shall also be numbered consecutively, the tables with headings containing Roman numerals as TABLE I, TABLE II, etc, and the figures with Arabic numerals as Figure 1, Figure 2, etc, appearing *below* the figures. The names of the authors and their laboratories or business connections should appear below the title of the paper.

ARTICLES APPEARING IN THE "PROCEEDINGS" IN RECENT ISSUES OF THE "AMERICAN DYESTUFF REPORTER" will be helpful to authors as models of form for the typing of manuscripts.

LITERARY STYLE AND FORM OF PRESENTATION—In the writing of papers, authors are requested to observe a trenchant, simple style of writing directed to textile chemists and colorists with at least an elementary knowledge of chemistry, physics, mathematics, engineering, textile processes and textile machinery.

In the organization of the material, there should be one or more introductory paragraphs setting forth the occasion, significance and main objectives of the paper and of the method of attack. This should be followed by the body of the presentation, either with discussions interspersed throughout this portion or with a collected section marked "DISCUSSION" after the main body of the paper. Finally, there may be a brief section at the end entitled "SUMMARY" of "CONCLUSIONS."

Center and side headings make for easier reading. Center headings should be employed sparingly and generally will include only very important section headings, such as "INTRODUCTION," "EXPERIMENTAL," "DISCUSSION," "CONCLUSIONS," "SUMMARY," and "REFERENCES." Side headings (see third paragraph of this *Notice* for an example) shall be indented and run into the text to which they apply, and shall be separated from the paragrpah by a dash. The publisher will print center headings in bold-face capitals and side headings in capitals.

LITERATURE REFERENCES AND FOOTNOTES—References to the literature and all footnotes (except those in tables) shall be numbered consecutively with underlined Arabic numerals in parentheses at the proper place in the text. Where a reference or footnote is to be used again, the original number is simply repeated; this obviates the necessity of repeating the footnote or reference at the bottom of the page. References to the literature shall conform to the universal usages followed by *Chemical Abstracts*, which include underlining of book and journal names to indicate italicization in printing.

The spelling and rules of punctuation followed in manuscripts shall be those found in the *Merriam-Webster New International Dictionary;* abbreviations and chemical formulas shall conform to *Chemical Abstracts*. Periods shall be used only at the end of sentences, not after abbreviations.

FIGURES AND GRAPHS—Figures and graphs should be black line drawings on white drawing paper. Photographic prints are acceptable, preferably glossy prints on double-weight paper. Duplicates should be available for dispatch to reviewers. Diagrams and graphs should preferably be designed in long form to cover one column of print but may be two columns wide or the width of a full page where necessary. In graphs the frame and actual curves should be inked more heavily than the co-ordinate lines, and these latter should not be too close together. Various styles of broken lines are sometimes desirable to distinguish curves. Experimental points should be given with small plane figures, such as circles, squares, diamonds or triangles. Numbers and legends on co-ordinate axes are to be lettered in the graph by the author. Numbers and titles of figures should be placed below the diagram or on the edge of the back. Each piece of illustration copy should bear on the margin or on the edge of the back the name of the author and the title of the paper.

Photographs of authors should be included with copy, to be run in conjunction with the paper. These must be on glossy stock, and should be large enough for proper reproduction.

TABLES—Tables should not be used indiscriminately because they are very expensive to set up in type. They should be designed to be one column, two columns or three columns wide. Tables should be arranged with the view of conserving space; column headings should be short and abbreviated. Quantity designations shall never appear in the body of the table but in the headings. Tables, if possible, should be placed in the manuscript where they belong rather than separately.

SYNOPSIS—A separately written synopsis of not over 200 words containing the gist of the subject matter must accompany every manuscript.

GALLEY PROOFS—Galley proofs will be sent to the author by the publisher for correction before publication. This should not be interpreted as an invitation to rewrite the paper but rather as an opportunity to correct errors.

REPRINTS—Fifty reprints of papers published in the *Proceedings* will be furnished without charge by the publisher if requested when galley proofs are returned. These reprints are printed on one side of the sheet only and then stapled together. A schedule of prices of reprints in the usual form accompanies the galley proofs.

OWNERSHIP OF COPYRIGHTS AND PATENTS—All papers presented at general meetings of the Association or at meetings of any of its local sections and all communications shall become the property of the Association. Such papers are not to be published elsewhere until they have appeared in the *Proceedings* of the Association. Papers published in the *Proceedings* are copyrighted by the Association. Any patentable disclosures shall of course remain the property of the author or authors.

TRADE-MARKS — As the AATCC wishes to co-operate in the protection of trade-marks, it is requested that, in the body of the article, trade-mark names be written with an initial capital letter. Courtesy demands that authors include competitive products as well as those of his firm. Many current trade-mark names are to be found in the *AATCC Technical Manual and Yearbook*.

GENERAL CALENDAR

AMERICAN CHEMICAL SOCIETY
National Chemical Exposition—Oct 12-15, Chicago, Ill.

AMERICAN SOCIETY FOR QUALITY CONTROL
Annual meeting, Textile Div—Jan 27-29, Clemson College School of Textiles.

CHAMBRE SYNDICALE TRAMAGRAS
International Detergent Congress—Aug 30-Sept 5, The Sorbonne, Paris, France.

DELTA KAPPA PHI FRATERNITY
1955 Annual Convention—April 29-30, Lowell, Mass.

DEUTSCHE GESELLSCHAFT FUR CHEMISCHES APPARATEWESEN
Achema XI—May 14-22, 1955, Frankfurt am Main, Germany.

DRYSALTERS CLUB OF NEW ENGLAND
June 25 (Annual Outing, Wachusett Country Club, West Boylston, Mass).

THE FIBER SOCIETY
Fall Meeting—Sept 13-14, McGill University, Montreal, Canada.
Spring Meeting—May 4-5, 1955, Alabama Polytechnic Institute, Auburn, Alabama.
Fall Meeting—Sept 8-9, 1955, Massachusetts Institute of Technology, Cambridge, Mass.

GORDAN RESEARCH CONFERENCES, AAAS
July 12-16, Colby Jr College, New London, N H.

INTERNATIONAL CONGRESS OF INDUSTRIAL CHEMISTRY
27th Congress—Sept 11-19, Brussels, Belgium.

INTERNATIONAL TEXTILE EXHIBITION
2nd Exhibition—June 25-July 10, 1955, Brussels, Belgium.

INTERNATIONAL WOOL TEXTILE RESEARCH CONFERENCE
September, 1955—Sydney, Melbourne, and Geelong, Australia.

NATIONAL INSTITUTE OF DRYCLEANING
4th Educational Conference, Dec 5-10, Silver Spring, Md.

SOUTHERN TEXTILE EXPOSITION
October 4-9 (Textile Hall, Greenville, S C).

TEXTILE TECHNICAL FEDERATION OF CANADA
4th Seminar—Sept 9-11, Queen's Univ, Kingston, Ont.

NEWS

• GAF Sales Divisions Celebrate Providence Expansion

Signaling the completion of construction to expand the present laboratory, warehouse and office areas at 85 Tockwotton St, Providence, R I, General Dyestuff Corporation and Antara Chemicals, sales divisions of General Aniline & Film Corporation, held a customers' luncheon at Tony George's in Providence on May 8.

Hosts were W A Lord, New England branch manager and W M Dewing, assistant branch manager, both associated with the company and its operations in the Providence area for many years.

A group of GAF-GDC executives headed by John H Hilldring, executive vice president and geenral sales manager, joined with the customers at luncheon and on a tour of the building.

• Dodgeville Processing Marquisette Under Avcoset Program

Dodgeville Finishing Co Inc, Attleboro, Mass, a recent licensee, is the first finisher to process rayon marquisette curtains under the Avcoset program for the quality control of washable rayon fabrics.

There are eighteen finishers and thirty-three converters licensed under the program, which is sponsored by American Viscose Corp. Avcoset fabrics, and garments made of them, are qualified to carry the Avcoset label.

• Zelomek Declares Apparel Trade Outlook Favorable

In an address before the Lowell Technological Institute Alumni Association at the University Club, Boston, Mass last month, A W Zelomek, president of the International Statistical Bureau, Inc stated that "the outlook for the remainder of the year in the textile apparel trade is more favorable than for the year to date".

He indicated that the following factors will help to create the business upturn:

1) Liquidation of "undue inventory accumulation".

2) New fibers, fabrics and blends.

3) "Normal coverage for fall" cannot be deferred much longer.

• New "Ban-Lon" Licensees

Six new companies were granted licenses last month to use the exclusive crimping process that produces "Ban-Lon" yarn, according to an announcement by Joseph Bancroft & Sons Co, which holds the worldwide rights to the patents. This brings the total number of licensees to 21.

The most recent agreements were signed by Textured Yarn Co, Philadelphia; Standard Hosiery Mills, Inc, New York; Holeproof Ltd, Australia; Bates Mfg Co, Lewiston, Me; Durham Hosiery Mills, Inc, Durham, N C, and Galtex Ltd, Galt, Ont, Canada.

• Hooker to Store Liquid Caustic at Vancouver

Hooker Chemicals, Ltd of Vancouver, British Columbia has filed a building permit for the construction of a 200,000 gallon tank for bulk storage of 50% liquid caustic at Johnston Terminals, Ltd, on False Creek in the City of Vancouver.

Construction is expected to be completed by the middle of June. Caustic will be brought to the storage tank by barges, operated by the Griffiths Steamship Co Ltd from the plant of Hooker Electrochemical Co at Tacoma, Washington.

Hooker Chemicals, Ltd, a subsidiary of Hooker Electrochemical Co with headquarters at Niagara Falls, N Y, acquired 60 acres of tidewater land at North Vancouver in 1952 for later development. The new storage tank is the first evidence of construction by Hooker in Canada.

• Short Course in Quality Control

A short course in textile quality control will be held at the School of Textiles at N C State College August 9-13, under the supervision of D S Hamby, associate professor in charge of quality-control instruction.

The one-week course, will be on an elementary level and will be aimed at introducing quality control techniques into textile mills not now fully employing this production tool.

• AMA Conference Highlights Troublesome Marketing Areas

Under the theme "How to Get More from your Marketing Dollar," the American Management Association held a two-day marketing conference in New York last month, which served to spotlight some of the more troublesome areas in marketing today.

Speakers emphasized the strategic use of marketing funds, proved methods of reducing and controlling marketing expense, and ways to measure procedures and performance. Case histories from nine companies illustrated positive and specific solutions to marketing cost problems.

• Barrymounts Used at Kenilworth Klinic

The Barry Corp, Watertown, Mass, was one of the companies selected to represent a cross section of American industry at the Kenilworth Klinic, Kenilworth, N J last month.

In this show, sponsored by the Kenilworth Steel Company and designed to stimulate thinking in production methods, packaging, finishing, and warehousing, seven of the ten exhibits with heavy machinery used Leveling Barrymounts, which are designed to prevent "walking", to level, and to isolate machinery from stock and vibration without bolting to the floor.

• Cyanamid Undergraduate Scholarship Program

American Cyanamid Company has established an undergraduate scholarship program in chemistry and chemical engineering to supplement its existing post graduate fellowships and grants.

Under the new program 17 undergraduates about to enter their junior or senior year will be awarded $600 each for the academic year 1954-55. In addition, each scholarship college will receive $300 for the unrestricted use of its chemistry or chemical engineering department.

Under the fellowship program, 15 graduate students in their final pre-doctoral year of study receive $1,500 plus full tuition and laboratory fees. Their department of chemistry or chemical engineering receives $300 for unrestricted use.

• 1954 Glycerine Research Awards Open

The Glycerine Producers' Association has announced that 1954 Glycerine Research Award nominations for outstanding research involving glycerine are now being sought.

This group of awards is granted annually by the Association to recognize and encourage research leading to new and improved applications of glycerine or glycerine derivatives to products or processes. First award is an honor plaque and $1,000; second award, honor certificate and $300; and third award, honor certificate and $200.

Official entry blanks may be obtained by writing to: Awards Committee, Glycerine Producers' Association, 295 Madison Avenue, New York 17, N. Y.

• MIT Summer Course in Textile Structures

A summer program in Applied Mechanics of Textile Structures, considering both natural and synthetic fibers, will be offered from July 19 through July 30 during the 1954 Summer Session at the Massachusetts Institute of Technology.

The program will deal with mechanical properties of textile fabrications as shown by the behavior of the individual fiber and by its structural configuration within the finished material. Directors of the program will be Professors Edward R Schwarz, professor of textile technology, and Stanley Backer, assistant professor of mechanical engineering.

Full details may be obtained from the Summer Session Office, Room 7-103, MIT, Cambridge 37, Mass.

NAMES IN THE NEWS

CARL F PRUTTON has been appointed vice president and technical director, Chemical Divisions, Food Machinery & Chemical Corporation. He will report to ERNEST HART, FMC executive vice president and will be located at the Chemical Divisions Administrative Offices, 161 East 42nd Street, New York.

In 1949 Mathieson Chemical Corporation appointed Dr Prutton vice president, director of operations, engineering and research, and he has also served as an officer and director of a number of Mathieson subsidiaries.

HANS W HILGERT of Dundee Mills, Inc, Clifton, N J has been appointed to the Executive Committee of The National Federation of Textiles by the NFT's president, WILLIAM N CHACE, Greenwood Mills. He succeeds JOSEPH W STARK of Klopman Mills, recently deceased. Mr Hilgert has been on the NFT Board of Directors since 1952.

E I Valko

EMERY I VALKO has resumed his relationship with Onyx Oil & Chemical Co as director of research, after having served in recent years as a project leader with the Polytechnic Institute of Brooklyn, and as an independent research consultant in the textile and allied industries. He was previously with Onyx from 1939 to 1946.

In 1952 Dr Valko was appointed to a 4-year term as collaborator of the Cotton Fiber Section, Southern Utilization Research Branch, USDA, New Orleans, La.

Onyx also has announced the transfer of E W KLUMPH, who has served the Charlotte, N C, area for over 20 years in the capacity of sales representative, to the state of Florida.

THOMAS A PRINTON, president of the Nopco Chemical Co, was awarded an honorary degree of Doctor of Laws from his alma mater, Boston College, at the College's 78th annual commencement exercises on June 9th at Chestnut Hill, Mass.

ERNEST NATHAN has been elected executive vice president of the Palestine Economic Corporation, where his duties will include direction of the activities of the Corporation, the largest American development company in Israel. He has been a director of PEC since 1951.

G Leigh

J Major

D F Newman

F L Esposito

IN staff promotions at Colgate-Palmolive Co, Jersey City, N J, GILBERT LEIGH, former head of the Quality Control Division, has been named assistant director of the Research and Development Department, and JOHN MAJOR has been named group leader and acting head of the Quality Control Division. Mr Leigh has been with Colgate since 1949, and Mr Major, since 1951.

A new member of the Quality Control Division is DAVID F NEWMAN, formerly with Kearfott Mfg Corp, Clifton, N J.

JA FIELD, assistant manager, Fine Chemicals Department, Carbide and Carbon Chemicals Co, a Division of Union Carbide and Carbon Corp, has taken a six-month's leave of absence from his job to be a consultant to the chemical division of the Business and Defense Services Administration, U S Dept of Commerce. He is slated later to become assistant administrator. The assignment will carry through to November 1.

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The following changes have been announced in Carbide's Industrial Chemicals Sales Division: M W DUNCAN has been tranferred to Denver, Col; J R RETTER has been transferred to Grand Rapids, Mich; and M R BRANNEN has been assigned to the St Louis district sales office. All three men are technical representatives.

JC PULLMAN, a member of American Cyanamid Co's New Product Development Department since 1952, has been appointed assistant to the manager of the Department.

Cyanamid has also announced the appointment of LEONARD E DUPRAS as a New England sales representative of the Pigments Division. He will report to WILLIAM A JACKSON.

C W BENDIGO, manager of Cyanamid's Fiber Development Department, was interviewed by Eloise McElhone on TV station WPIX (New York) last month in connection with Chemical Progress Week. He discussed the new synthetic fibers.

C Thompson

CHARLES THOMPSON has been appointed group leader in dyeing application for the Chemstrand Corporation.

Among his more recent affiliations was that of chemist-colorist in charge of New York sales division laboratory for the Burlington Mills Corp.

MAKING his first visit abroad since he arrived in this country from England in 1913, JAMES PILKINGTON, chief chemist at Riveredge Printers, Inc, Fall River, Mass, sailed June 1st from New York on the M V Saturnia for Lisbon, Casablanca, Algiers, Barcelona and Genoa.

For this trip, Mr Pilkington has selected wearing apparel made of Dacron, nylon and Orlon with the hope of being able to ascertain the relative potentials of the various synthetics from a traveling man's standpoint.

GEORGE B MONK, as fiber sales and service representative for National Aniline Division, Allied Chemical & Dye Corp, will be concerned with A-C nylon soon to be produced at the Division's Chesterfield plant, now under construction at Hopewell, and Bermuda Hundred, Va.

Mr Monk joins National Aniline after having been with American Bemberg for the past seven years.

FRANK L ESPOSITO has been named controller of General Dyestuff Corporation and the Dyestuff and Chemical Division of General Aniline & Film Corporation. Mr Esposito, who had been controller at the company's Linden, N J plant since 1950, succeeds ARTHUR J YOUNG who was recently elected controller of General Aniline & Film Corporation. Announcement of Mr Esposito's appointment was made by JOHN C FRANKLIN, vice president operations, to whom he will report.

FRED M PUGH has been promoted to the post of manager — Midwestern Sales District of the General Electric Company's Silicone Products Department. Silicone sales representatives in Cleveland, Detroit, Chicago and Cincinnati will report to him through his location at 1105 Chester Ave, Cleveland.

THE 1954 Honor Scroll of the New York Chapter of the American Institute of Chemists was presented to HANS THACHER CLARKE by KARL M HERSTEIN, chairman, at the Chapter's annual meeting on May 20 at the Hotel Commodore. Dr Clarke is currently professor of biochemistry and head of the department, College of Physicians and Surgeons, Columbia University.

C Pacifico

CARL PACIFICO, former director of development for Wyandotte Chemical Corp, has been named director of market development for American Alcolac Corp, Baltimore, Md, manufacturer of industrial synthetic detergents.

RICHARD D WELLS, director of research, Bates Manufacturing Company, was elected chairman of the General Research Advisory Committee of Textile Research Institute, and W HALE CHARCH, director, pioneering research, Textile Fibers Department, E I du Pont de Nemours & Co, Inc, was elected vice chairman, at a meeting held in the Institute's Princeton Laboratories on May 20-21.

M J HOOVER has been appointed sales director of Sun Chemical Corporation and a member of the Corporation's management committee. As sales director, he will be responsible for the coordination of the activities of all Sun Chemical's sales divisions, including Warwick Chemical Co.

Since joining Sun in 1936, Mr Hoover has been general manager of one of its sales divisions.

S Y Stribling, III

W S Pearson

THE Hilton-Davis Chemical Co has appointed two sales representatives to handle its line of textile pigments in the Southern states.

S Y STRIBLING III, former sales manager of textile pigment colors for Warwick Chemical Co, has been named Southern manager of textile pigment sales, with headquarters in Greenville, S C; and WILLIAM S PEARSON, former technical representative for Warwick, will represent Hilton-Davis in textile mills in Georgia, Alabama and Tennessee. Mr Pearson's headquarters will be in Decatur, Ga.

R E Elwell

THE appointment of RALPH E ELWELL as Southern sales representative covering North and South Carolina, has been announced by Berkshire Color & Chemical Company, Delawanna, N J. He will make his headquarters in Charlotte.

Mr Elwell has represented Sandoz Chemical Works in the Paterson, N J area for the past four years.

ROBERT J POLACEK has been named technical assistant to the manager, new products—organic chemicals department in the Michigan Alkali Division of Wyandotte Chemicals Corporation. Mr Polacek joined Wyandotte's development department in 1951.

CHESTER J PETKIEWICZ, a member of the junior class at Lowell Technological Institute, has been named as one of the four national winners of the Armed Forces Chemical Association Award. This award is presented annually to an Air Force ROTC Cadet for outstanding achievement in the field of chemistry.

Earlier this year, Cadet Petkiewicz was one of the Interchemical Corporation Scholarship winners for outstanding achievement in the field of chemistry.

OBITUARY

ERNEST B BENGER

ERNEST B BENGER, one of the country's outstanding authorities on synthetic fibers and films, and former director of the Technical Division of Du Pont's Textile Fibers Department, died at his home in Wilmington, Del on May 27. He had been ill for some time.

Dr Benger, who was 68, retired in 1947 after 30 years with the company.

EDWARD A STABER

EDWARD STABER, sales manager of the Dry Color Department of Zinsser & Co, Inc, died on May 14th at his home in River Edge, N J.

He was formerly connected with the Ultro Chemical Corp, manufacturers of dry colors, which in 1926 was absorbed by Zinsser & Co, Inc.

NAN M COLLINS

NAN M COLLINS, owner of the Nan M Collins Advertising Agency, died Tuesday, May 11, at St. Luke's and Children's Medical Center, Philadelphia, after several weeks' illness.

Miss Collins, after having been an account executive for over twenty years with another agency, organized her own business in 1950.

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